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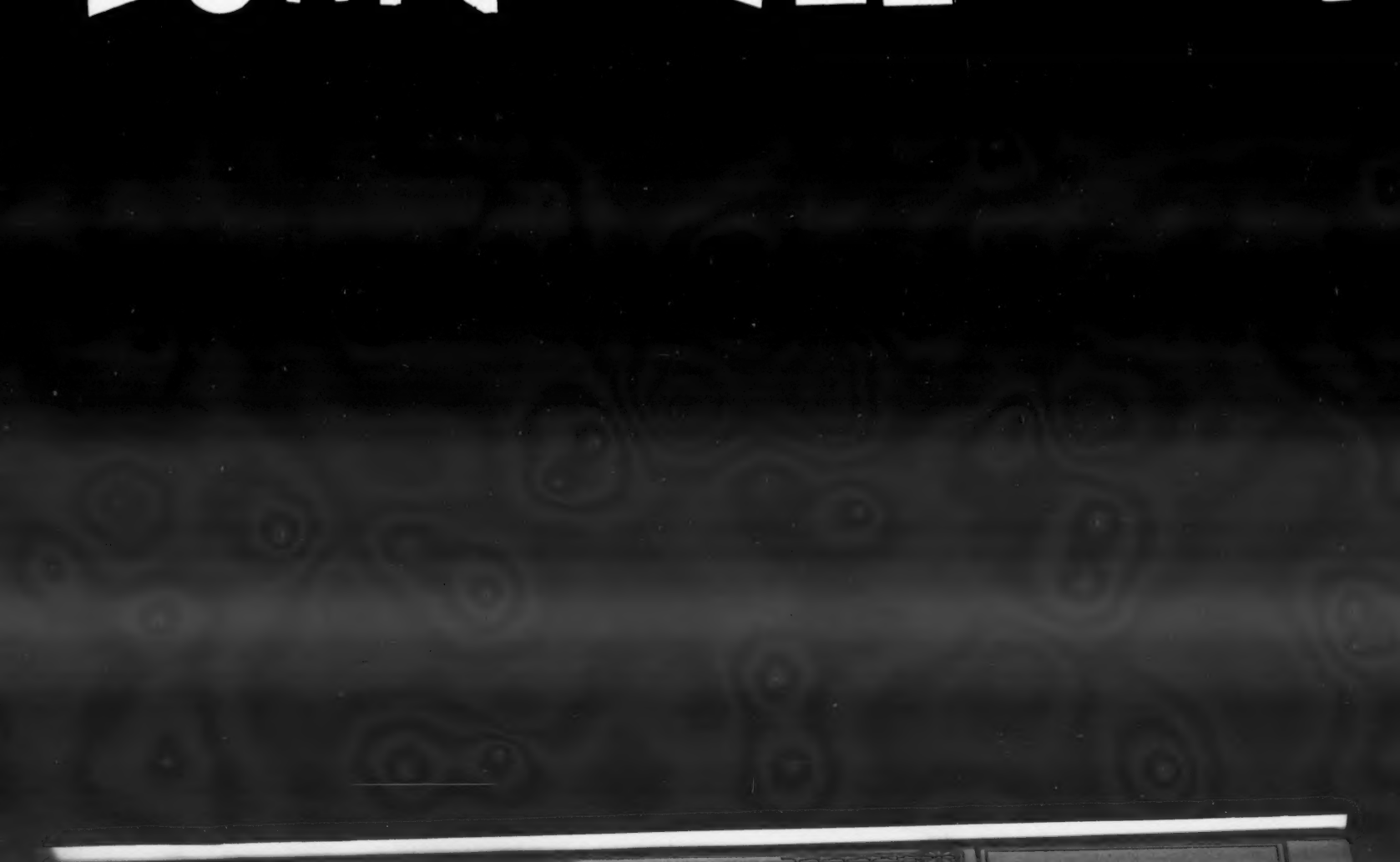


The Geographical Journal

Vol. LXI No. 4 April 1923

"MUFÚMBIRO": THE BIRUNGA VOLCANOES OF KIGEZI-RUANDA-KIVU

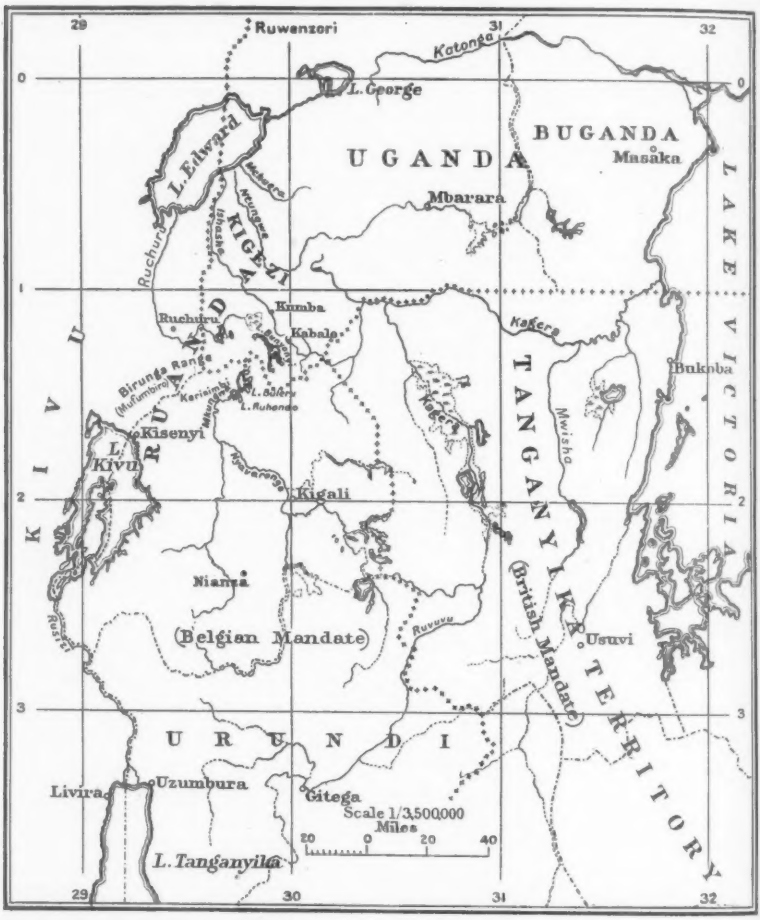
Captain J. E. T. Philipps, M.C.

Read at the Meeting of the Society, 29 January 1923.

THE part of Africa which I shall attempt to describe to-night lies close to the Equator, principally between 1° and 2° S. lat., and between 29° and 30° E. long. The high country surrounding this mountain range has been called "the roof of Africa." In it are situated some of the ultimate sources both of the Congo and the Nile. This crescent-shaped chain of peaks and craters which has burst up in and across the floor of the valley of the Great Divide would seem to answer more fittingly to the ancient expectations of the Mountains of the Moon as the source of Father Nile. "The aspect of this country," says incidentally a competent observer, "can be likened to nothing so much as a view of the Moon as seen through a telescope." The Ruwenzori mountain, which is sometimes understood to represent the idea of the Mountains of the Moon, is, owing to dense conglomerations of cloud and mist, much less often visible than any of the mountains of the Birunga range. Three frontiers pass along the summits of the Birunga, the Anglo-mandated (lately German), the Belgian-mandated, and the Anglo-Belgian; and it is in the vicinity of these frontiers that I have had the good fortune to spend over two years immediately after the war.

The Kingdom of Ruanda, which in the local language signifies "the realm," extended, until delimited (in 1911) and divided by the Powers, over portions of what is now British and Belgian territories—northward to the edge of the scarp overlooking lake Edward, and westwards round the immediate shores of lake Kivu. To-day the British portion of Ruanda lies politically within the Kigezi District, the mandated territory remains Ruanda proper, and the Belgian Congo portion is within the Belgian District of Kivu. The present frontiers are far from ideal from an ethnological point of view, but I should like particularly to place on record how well the results of the Boundary Commission of 1911 have stood the test of time. Despite the fact that the frontier had to cut through wild irregular country and through wilder

and more irregular tribes and could not follow broad natural boundaries, it has been so designed as to take advantage of every *possible* natural feature, which has greatly simplified the task of the soldier and administrator. Very frequently in negotiations with our neighbours across the



Sketch-map of Ruanda and Urundi.

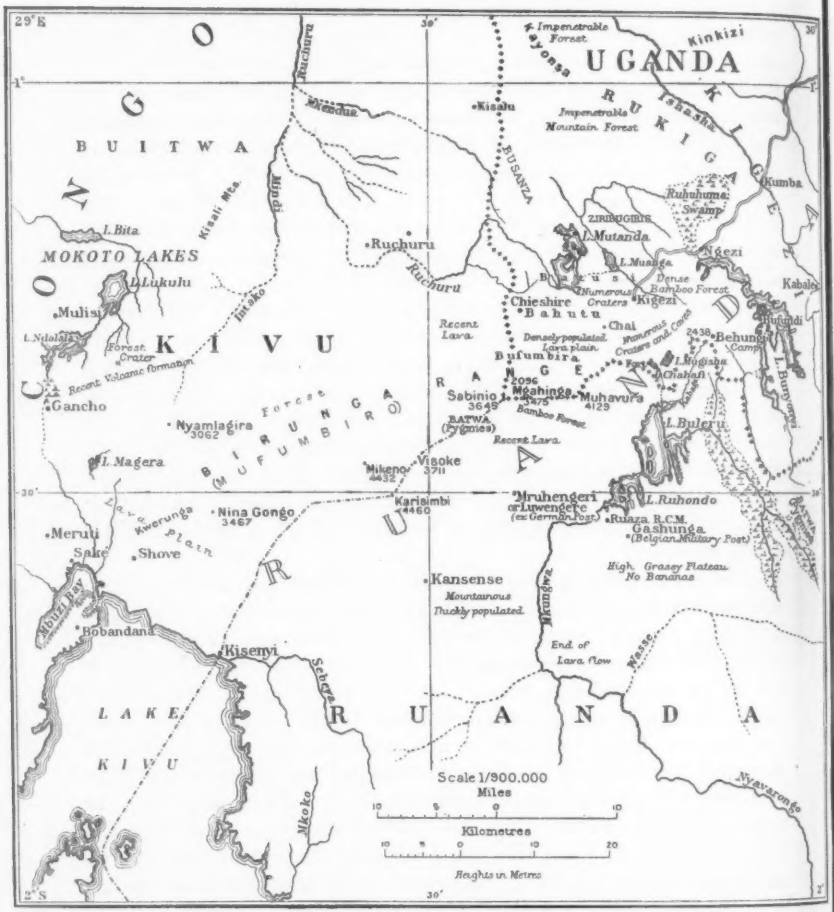
border, or in pursuit of frontier raiders in the south-west, we have had cause to bless the name of Colonel Jack and his Commission.

Long after the establishment of European Protectorates in German East Africa and Uganda, and after the setting up of the Congo State. the powerful and compact Kingdom of Ruanda with its some two million

inhabitants remained virtually a closed district. The Ruanda language, probably the most difficult of Bantu tongues, is not spoken outside the Urundi–Ruanda plateau. Incidentally there does not exist even now any English–KinyaRuanda interpreter, black or white. There was little communication between the plateau and the neighbouring lowlands, a condition which still holds good to-day. The respective natives reciprocally suffer in health by the abrupt climatic change. Arab slavers and alien raiders equally failed to penetrate into the realm. It is thus not surprising that there should have been an outside and an inside name, so to speak, for these volcanoes. Thus in the Luganda and Runyambo languages of Buganda and Karagwe, Mufúmbiro or Mchúmbiro would be the equivalent of the word "cooker." In Karagwe, whence I first saw the range, I recollect that the word "cooker" only referred to the mountain of *fire*, and that it was to them, half in fun, half seriously, "the-cooking-place-of-God." The volcanoes lie entirely within the Ruanda country. The word Mufúmbiro does not exist in the Ruanda language, the only one spoken in this region. The singular KiRunga in the Ruanda tongue signifies a volcano. The KinyaRuanda word Runga means in a technical sense "mix," and is generally used for the mixing of cooked vegetables with meat at a meal. The reference, in so far as the obvious may be accepted, according to the natives of the vicinity, may be to the fact that the mountains appear to mingle clouds and smoke upon their densely vegetated slopes. Of the charcoal burners, who frequent the lower slopes of the mountains, it is always said in their absence, "They have gone up to the Birunga." It is thus used collectively of the range.

The most comprehensive view of the volcanoes is from the little hill, upon which is situated the Belgian post of Ruchuru, in the Rift and some 20 miles north of the middle of the range. The most impressive view however is probably in the British district of Kigezi from the lip of the Behungi ridge. The only road from British territory climbs the Behungi hill through bamboo forests from the east. It is thus that the vast panorama bursts upon one with unexpected suddenness. It makes one catch one's breath in admiration and astonishment. The very heavens seem full of the immensity of it. Southward gleam the twin fairy lakes Buleru-Ruhondo. Directly in front, some 2000 feet beneath, one looks down into the small craters which have sprung up mushroom-like in the lava plain below. Their grassy sides are dotted with grazing cattle or with the bright chess-board pattern of native crops. At the foot are native homesteads, enclosed in euphorbia fences, and between them winds the one clear ribbon of the raised cinder path straggling away westward to the border and the Congo posts beyond, the whole backed by the further wall of the Divide where Western Africa begins. North-west through a slight haze is the gleam of the Mutanda lake, marked out with little green islands and backed with

wild broken mountains over which are inscribed on all the maps the words "Uninhabited" and "Impenetrable forest." It is from the gloomy confines of this frontier forest, complicated by an international boundary, that the raiders of the Nabingi movement used until recently to emerge to harry and terrorize the fat lands south and east. Most often



The "Mufúmbiro" or Birunga range.

to the south-west there is a long belt of cloud which obscures partially the great feature of the landscape. It is with a start that one realizes something infinitely greater which is looking down upon one from above the cloud belt. It is the towering head of Mount Muhavura, the grim teeth of Sabinio, and the snow-capped crest of Karisimbi, this last of

1. DISTANT VIEW OF MUFUMBIRO MOUNTAINS FROM ABOVE KUMBA, LOOKING SOUTH-WEST
Phot. R. E. Critchley-Salmonson.

2. MGAHINGA AND SABINIO FROM THE NORTH
Phot. J. E. T. Phillips.

3. MUHAVURA AND LAKE CHAHAFI FROM BEHUNGI
Phot. J. E. T. P.

4. MUHAVURA AT EVENING *Phot. R. E. C.-S.*

5. LAVA BLOCKS BELOW MUHAVURA PILED TO ALLOW CULTIVATION
Phot. J. E. T. P.

6. KIGEZI FROM THE CAVES NEAR MUHAVURA
Phot. R. E. C.-S.

over 14,000 feet. It is only at dawn that the mountains are nearly always clear. The cloud lifts, the sun strikes and gilds the mountain-tops, and a golden light rolls down their mighty flanks towards the plain. It is only then that the abruptness and full majesty of these gaunt sentinels can be gauged. Far below, with the dawn, the barking of dogs, the lowing of kine, and the awakening call of the herdsmen come floating up to the Behungi camp. Spirals of blue smoke begin to curl into the still air. Through glasses one can see the men come forth from their homesteads lifting their eyes to the hills to mark the omens for the coming day. It is a race of wild volcanic mountaineers whose folklore and religion are bound up with the brooding monsters which stand as givers and guardians above them in life, and in death provide their heaven and hell. To understand the people it is necessary to understand their mountains too. From the mountains come their water, their firewood, their building timber, their rope, and the charcoal for the iron-smelting which is their only trade. Their cattle graze on the young shoots of the bamboo, some never leaving the forests of the lower slopes.

The range consists of eight principal mountains. One has been able on several occasions to reach the summits of all of these with the exception of Sabinio and Mikeno. Most easterly of the Birunga is Kirunga-cha-Muhavura, or more simply Muhavura, the "guide." It is the Mnya-Ruandas' signpost and compass when abroad. It is Muhavura which is most often clear of cloud and most visible from afar. It is the sacred mountain, and alone of the volcanoes is at present never ascended to the top by the local natives, with the possible exception of the pygmies. The eastern group of the range consists of Mounts Muhavura, Mgahinga, and Sabinio, which divide British from ex-German territory. The central group is Bissoko, Karisimbi, and Mikeno; the two former divide the late German colony from the Belgian territory. Nina-Gongo and Nyamlagira are the most westerly and lie, as Mikeno, wholly in the Belgian Congo. The highest mountain of the range is Karisimbi of 14,780 feet; the lowest is Nyamlagira of 10,046 feet. The latter is still active and is probably the most recent formation. To take the mountains in turn from Muhavura westward, the natives understand the names in the following sense, though they are not set down as being therefore necessarily correct deductions.

Mgahinga: from Hinga, "cultivate." The inhabitants of the sub-district of Mlera, south of the mountain, purchase their agricultural implements from ironworkers in Busanza, a day's march north-west of Mgahinga. The path over the range, from Mlera to Busanza, passes over and along its sides. It is thus known as the cultivator's hill. Incidentally it is in this saddle between Mgahinga and the Muhavura that would-be native buyers are sometimes attacked on their way north and robbed by pygmy bands.

Sabinio: "Where three empires met." The word Sabinio signifies

roughly "Father of Teeth." Its serrated crest gives the immediate appearance of a set of enormous teeth.

Visoké, or preferably Bissoko, is the "drinking-pool," from the word Soka, which is used for the process of watering cattle. There is a noted pool high upon its southern slopes, popularly supposed to give increase to cattle watered there. The alternative map-name of Kissassa is applied to its northern foothills as distinct from the mountain itself.

Karisimbi: possibly from the word Nsimbi, or white cowry shells, a form of native currency, denoting the glistening whiteness of its snow-clad mountain-top.

Mikeno, or "Place of Poverty," from the word Keni, "poor." Its slopes are largely covered with lava boulders which preclude habitation, cultivation, or pasture. Such grass as there is below is the reverse of fattening for cattle.

Nyamlagira: "The Commander" or "overseer," from the word Lagira, "supervise." The name Nyamlagira is a synonym for the Ruanda deity Imana. On the night of 17–18 May 1919, from Kanyamwongo beach on lake Edward the flames of a minor eruption of Nyamlagira were very plainly seen. It was a clear night, and the preliminary glare cast into the sky from the volcano was most unusually red and thrown up in regular jerks like that of a flickering lamp. On climbing to the crater in 1919 we were nearly asphyxiated by a sudden change of wind from the south-east to the south-west, which blew down an enveloping cloud of sulphurous fumes upon us. We only escaped with considerable difficulty over the rough spiked lava.

Nina-Gongo, or more usually Nyira-Gongo, "Mother of Gongo": the significance of Gongo in the local language would be a "back." The mountain is periodically active and was smoking in 1921. Traditionally souls of the people found, on judgment, to be either "profani" (the word is *Inzigwe*) or of evil-doers are cast into its depths. There are also minor craters on the western side of the Divide.

It is difficult throughout Africa and particularly in this area to obtain any comprehensive names for any large sheet of water or even a river. The inquirer is usually met with a complete lack of understanding of what is required. In the case of a large lake or sea where it is desired to record a name for the sheet of water itself or an indentation of it, one is frequently met with the blank reply, "It is just water. It comes and goes and changes. It has no name." There are cases where the occurrence of some striking incident in a particular part of a lake may have given a name to that portion of the water, as for instance a wide bay in the south-west of the Victoria Nyanza where two war-canoes were wrecked at sea and ninety persons drowned. It is called *Kienda*, meaning ninety, as one might say "*kienda*-of-the-ninety-dead." As is well known, the lake names Nyasa, Nyanza, and Tanganyika merely

signify, or come to signify, in the languages of the peoples inhabiting their shores, "a large sheet of water." This is also the case with an alternate map-name for lake Edward, namely Ngezi, which is the word for a lake among the people of the eastern, that is the British, side. It is a different word among the peoples on the northern, western, and southern shores, but this is in foreign territory, so apparently was not recorded. The second synonym, namely Ruite Nzige, meaning "it kills locusts," has reference to the not infrequent occurrence of the falling into the lake and perishing of flights of locusts on their way across it. Thus the unpleasing habit of fastening exotic names upon physical features of little-known countries is to some extent justifiable in the case of the African lakes, whereas it would seem quite uncalled for in the case for instance of mountains which, entering so largely into the lives and folklore of a primitive people, have always expressive and often euphonious appellations. In this respect the Birunga volcanoes, in spite of occasional threats, have so far happily escaped with their names.

In reference to the Kivu lake, the people of its western or Congo side refer commonly to the lake as *Tanganyika*. It is thus not improbable that if the European discoverer of lake Kivu had first seen it from the western instead of from the eastern (Ruanda) shore it would be known, if not as Tanganyika, at least by quite a different name to-day. Kivu in the Ruanda language signifies "any large sheet of water." It would be a doubtful though tempting task to identify it etymologically, through the root *-vu* meaning "ashes," with its probable volcanic origin.

To fix the names of rivers is even more difficult in some parts of this area. One instance will suffice. There is a river which runs through a deep papyrus swamp in Rukiga which has at least ten names or epithets in a distance of 12 miles of its course. Each division of the mountain ridges each side, with their river frontage, is here occupied usually by a separate clan of the tribe. Each clan in many cases uses a different word to indicate their little section of the river. Thus taking the river from its rise, one gets the following as "names" of the river, giving in each case the English equivalent of the native words: The Bubbler, that is the Spring; the Source; the Rivulet; the Stream; the Percolator; the Moistener, that is Irrigator; and, where it leaves its swampy course to emerge into a clean rocky valley, it is known as the "Clear-runner"; again, in passing into the territory of another tribe speaking another dialect, further north it is called "the Beck" and "the Burn." The majority of these people, especially the women who are the most concerned with the river, seldom leave their natal mountain from birth to death, and therefore the phrase "go to the river," knowing only one and that *their* section of it, entirely suffices them for everyday speech. There is therefore no incentive for them to give a river a proper name at all, still less for all its course.

Regarding the water system of the volcanic region, the greater

number of the rivers rising in the vicinity of the volcanoes belong to the Nile watershed. Of these some flow into lake Victoria and others into lake Edward. In one case, directly below the British post of Kabale in the Rukiga county of Kigezi, the Mvumba, a tributary of the Victoria, rises within a few feet of the source of the Ishasha, which flows into the Edward. In greater rains their sources are often merged in the same swamp. This is also the case with the sources of the Ntungwe and the Rufua on the north-eastern border of Rukiga. It is curious that in neither of the former rivers are fish to be found during their course through Rukiga, whereas their lower reaches swarm with fish. The same fact applies to the lake Bunyonyi, and in fact to any of the lakes in the British corner of Ruanda, that is in the counties of Rukiga and Bufumbira. In each case the rivers which carry off their waters contain fish in their lower reaches and there is little obstacle in the way of falls, to their ascent. In each case both otters and frogs exist in these lakes, the latter forming the principal diet of the former. Lake Bunyonyi, meaning "little birds," is a wild and lonely mountain lake in Rukiga. It is some 15 miles long and about a mile wide, and is the furthest source of the Edward-Albert branch of the Nile. Lake Bunyonyi is the principal source, viâ lake Mutanda, of the Ruchuru, which however draws water also from two minor streams originating on the slopes of the active mounts Nyamlagira and Nyiragongo. Fish are not found above the confluence of the Mindi, the lowest of these two tributaries. The possibility therefore occurs to me that these waters may be so strongly charged with injurious matter thrown up and drained from the craters as to discourage the running up of fish from lake Edward. In support of this theory I would adduce the absence of crocodiles on this southern shore of the Edward lake. I used frequently to bathe from the southern shore, and native fishermen further allege that crocodile are never seen on this side of the lake. A comparative analysis of the north-eastern and south-western waters of the Edward Nyanza, of which I sent samples to England in 1920, shows a marked difference in composition, the more northern being the purer. In the case of the Ishasha, an explanation may perhaps be found in the existence in the bed of the river, some two hours' march north of Kumba, of boiling springs strongly impregnated with sulphur. In the Kayonsa forest, some 20 miles below, I have caught fish without difficulty. In the Ntungwe River, which forms the northern boundary of Rukiga, fish exist throughout its course from Lake Edward to the source. Again, the Chahafi lake in Bufumbíra forms the source of the Mkunga-Nyaruwongo River which joins the Ruvuvu-Kagera at Kasseke. It lies at the eastern base of Muhavura. The country directly surrounding it is covered with a vast *débris* of lava boulders. There are no fish in the lake. In ex-German territory, the two adjacent lakes of Buleru and Ruhondo, which receive the Chahafi overflow underground, contain fish, chiefly a small barbel. These

phenomena were so puzzling that I decided to make an experiment in stocking lake Bunyonyi, and despatched a sample of the water to England for analysis. The reply was to the effect that the water was quite free from any deleterious matter. I then obtained, not without difficulty, small fry from lake Edward, lake Kivu, and from the Kagera. They were placed in fish ponds, fenced round with wire and bamboo on the lake-shore, and thoroughly protected against the marauding otter. The fish flourished in the pond, and each month a small consignment was placed in the lake. Unfortunately an attempt to obtain rainbow trout failed. These would probably do very well, and there is ample feed. Frogs and leeches also abound in the lake, of which the average temperature was 68° throughout 1919. Later in the year the BaChigga natives on the eastern shore came in to report " new creatures " which they described as " Like spearheads " swimming in the lake, and asked what was to be done about it. For fear that the appetite, once awakened, might prematurely grow in eating, they were told that it would scarcely be wise to consider the new creation to be edible as yet. But the BaHutu inhabitants of the further shore. who are frog-eaters, soon found the new-comers to be to their taste. Despite amateurs however, both natives and otters, I had the satisfaction before leaving the district a year later to find the fish fully established. The poverty-stricken lake-side natives, who had always found it difficult to pay their Government taxes, were making money by supplying the market at Kabale, where fish have appeared for the first time in its history to the satisfaction of all concerned. The lake-shores, largely depopulated by disease and Pygmies before and during the war, are gradually becoming to be considered again as desirable building sites, and all who live there combine to keep their fishing a close preserve. It would thus appear that in the waters of the five lakes on the north side of the Birunga there is nothing at present repugnant to the establishment of fish.

On one of the northern islets of lake Bunyonyi the natives maintain a long-established quarantine. Here they immediately isolate and keep under close observation those of their stock that show any sign of contagious disease. This sensible custom has been a material assistance to the administration in dealing with local cattle epidemics. Upon the most southerly island I was able to establish a small zoo for the observation at close quarters of local game. Six different species of big game were thus placed and maintained upon the island under natural conditions. They flourished exceedingly, and it was not difficult by means of a canoe, made up to resemble one of the many floating islands of papyrus, to approach the island and observe the animals for hours together at very close quarters without exciting their suspicion. On the western side of Bunyonyi lies the rocky valley of Kabga. It is a mountain salient into British territory (which for good reason we named the Cave of Adullam). In Kabga one may see whole mountain slopes each side

covered with an uninterrupted crop of peas. When the purple flowers are in bloom the mountain-side appears in the distance to be ablaze with a bright heather colour. The peas are not picked until they are brown and dry. They are subsequently used as a portable ration for journeys. They are easily cooked, being merely roasted over a bright fire in any piece of broken potsherd. When cooked they taste rather like chestnuts.

To move to the western extremity of the Birunga range: it is generally held that lakes Kivu and Edward were at one time a single sheet of water lying in the rift; that a vast volcanic upheaval, now represented by the Birunga range, burst up underneath in and across the floor of the Great Divide, thus creating two lakes instead of one; that the waters of Kivu were by this means cut off from the Nile and the Mediterranean and forced as they accumulated to find another outlet to the sea. The lowest point of the marginal mountains being in the south, the waters of Kivu made their channel southward spilling down by the Rusizi into lake Tanganyika, and thence, by the Congo, to the Atlantic. The extent of the watershed of lake Kivu is very circumscribed; no river of any size falls into it. One of the largest is a stream which falls through more than a mile of steep cascades into Saké Bay in the north-west corner of the lake. Its water in spate is a bright red, which colours the clear grey-green lake far out into the little bay. By the bursting up and the eruption at the western extremity of the Birunga of the new crater known as Kwerunga, in 1912–13, the northern shore of lake Kivu was again pushed out southward by the flow of lava. The narrow entrance from the lake to Mbusi Bay was thus almost blocked and the bay itself nearly became a separate lake. The marginal rocks of Kivu, including the new lava, are everywhere becoming whitened within the reach of the waves. Fish, which in Kivu are almost entirely Siluridæ, are scarce in this the north-western part of the lake, but plentiful south of the island Kwa-Idjwi. This is both my own experience in fishing in all parts of the lake and is borne out by statements of native fishermen. The average temperature of the lake taken at all seasons, and over periods of a month at a time, shows 78° F. The general temperature of streams falling abruptly into the lake from the lofty marginal mountains of the west is 66°. Sulphurous fumes and frequent tongues of flame are still met with among the fissures on the eastern slopes of the new crater, on the north-western shore of the new lake. Through the kindness of the Government chemist one has been able to obtain an analysis of the Kivu water taken from the north of the Mbusi Bay in the proximity of the new lava-flow. The following extract from the report is of considerable interest:—

"The presence of sulphuretted hydrogen in the water of lake Kivu would certainly be detrimental to fish life, and, if evolved in large volumes from fissures or springs, would undoubtedly be dangerous to human

beings as well. Seven parts of sulphuretted hydrogen in ten thousand parts of air have been known to kill a human being."

The proportion found in the sample is one part per 100,000.

"The water contains a certain proportion of boric acid, probably present as magnesium borate. Boric acid and its compounds are often found in the regions where volcanic activity is common, and in this instance may account for the white deposit formed on the marginal rocks."

It is not surprising, under such conditions, to find hot springs in the lake, some of such temperature as to give a feeling of acute discomfort to any one chancing to swim across them. The springs are presumably of great heat if, after diffusion from considerable depths, the surface water is so strongly affected. But on no less than three occasions I have swum, between Bobandana and Shushu Island, into black oily patches on the surface of the water. These came up suddenly in bubbles which broke round one's face with considerable heat. A personal detail may serve to show the consistency of the oil in that it was exceedingly difficult subsequently to remove, even with soap and clean water. In reference to the oil, the phenomenon is here recorded on the possibility of its being worth further inquiry.

Between mounts Nyiragongo and Nyamlagira and further west, an extremely difficult position to reach owing to the sharpness of the pointed lava blocks, there are sometimes distinct sounds as of a subterranean torrent. My last visit was during the dry season. I was unable there to find any *open* access to water, nor is any visible from these points. There is, one might suppose, a remote possibility of a subterranean connection between lake Kivu and lake Edward which lies some thousand feet lower.

According to native tradition, unanimous among the three tribes at the western end of the range, major eruptions in the Birunga occur at a cycle of eight years. In point of fact there were two violent explosions, which could perhaps hardly be termed eruptions, heard in November 1920, when part of a southern wall of the Kwerunga crater was blown out, and part of the south-eastern lip of the crater seems to have fallen in. This is roughly eight years since the last eruption 1912–13. Several old men of villages neighbouring Rugari between Nyamlagira and Mikeno recall that their grandfathers had told them that they grazed their herds in that part of the Divide, at present devegetated and almost impassable, where Nyamlagira lava blocks now lie.

Only the southern slopes of Nyamlagira and Nyiragongo and the south-western slope of Karisimbi drain into the Kivu–Congo basin. The remainder of the Birunga range is within the watershed of the Nile. Their drainage is carried either northward through Edward or westward through the Victoria Nyanza.

High in the saddle between mounts Muhavura and Mgahinga there

is a small pond of which the water is carried off northward down to lake Mutanda. Many mountain animals drink at this pool. There are similarly two rivers which rise apparently from the interior of Mount Sabinio and run principally underground. One joins the Kako River near Ruchuru and the other runs into lake Mutanda near the exit of the Kako from it. The latter is twice visible in the lava crust, and then only for very short distances. The former can be heard distinctly in many places where it cannot be seen. Both rivers are of a greyish lava-dust colour, are cold and flow swiftly. Neither appear dependent on storm or flood waters. This would seem to point to a subterranean spring or reservoir in the mountains, of the same nature perhaps as those supplying the surface ponds on Muhavura and Mgahinga. There is an odd phenomenon at times to be seen near the summit of Muhavura. In heavy rains the water of the northern cap collects and rushes with such force over the lower rocks of the cone as to shoot off into space at an apparent angle of about 45° to the mountain, falling again to the mountain-side about 500 feet below. The resulting jet of water gives a very curious effect seen from below, as it rises and falls, varying frequently in volume and therefore in angle, during the course of a heavy storm breaking over the mountain-top, when the weather may be perfectly clear and dry in the plain below.

Near Ruhengeri, in the southern lava-flow of Muhavura, there is a mineral spring of very cold and highly aërated water. It is very pleasant drinking, and analysis made, by the courtesy of the Government chemist, shows the following rather remarkable result:

"The water is an alkaline mineral water of the weaker type, such as Vichy, but the presence of relatively large proportions of magnesium carbonates and sulphuretted hydrogen gives the water the medicinal characters of the weaker Harrogate springs. . . . There is one characteristic of this water to which special attention may be directed, namely the high proportion of potash to soda. In most cases the ratio does not exceed 1 to 10 and only rarely is it so high as 1 to 5, but in the sample here considered the ratio of potash to soda is 9 to 8. The water would therefore probably be found to possess some special features as a medicinal water in addition to those arising from sulphides and carbonates."

From the Birunga there radiates a line of hot springs, which show in the Ruindi, Ishasha, and Ntungwe valleys towards Uganda.

In northern Rukiga, slightly south of the hot springs of the Ntungwe a curious phenomenon recently occurred. In the little enclosed valley of Kimbugu a small lake welled up during the night. Some fifty houses were situated on the grassy and gently sloping hillside round Kimbugu. The water did not touch the buildings, but some thirty people were found dead in their houses in the morning, presumably from the noxious fumes exhaled by the water. Previously there had apparently been no pool

7. THE ISLAND IN LAKE MUANGA (MURCHI)

Phot. R. E. C.-S.

8. LAKE MUANGA (MURCHI)

Phot. R. E. C.-S.

9 SOUTH-WEST ARM OF LAKE BUNYONI

Phot. R. E. C.-S.

10. THE ISLANDS OF LAKE BUNYONI, SOUTH-WEST ARM
Phot. R. E. C.-S.

11. KAYONSA FOREST, RUKIGA, FROM THE NORTH-EAST
Phot. R. E. C.-S.

12. THE ISHASHA RIVER BETWEEN CHINCHIZI AND KAYONSA
Phot. R. E. C.-S.

or stream in the valley. Water now covers about 100 yards square of it, with a maximum depth of 14 feet. The valley is now almost deserted and the lake is tending to disappear. In June 1920 the water appeared almost to have lost its noxious fumes, but had a distinct odour of sulphuretted hydrogen, and, to a less degree, of paraffin. Analysis of the water has not shown any unusual or deleterious qualities.

I should like to add a few remarks on observations of the *game* of the Birunga range. The Great Divide runs north and south. The Birunga range occupies a central position in and across it. These volcanoes are at the extreme west of eastern Africa, and at the same time at the extreme east of western Africa. It is near here that the westward traveller leaves the open savannah lands of eastern Africa to enter the great equatorial forest which stretches intermittently to the Atlantic coast. The Great Divide, or Albertine Rift, this deep fold or scar across the face of Africa, lies between. Here the Birunga range stands athwart it like a bridge. The Chingogo, Birunga, and Kayonsa mountain forests are wedges of woodland thrust into an otherwise treeless bare plateau. Here meet together some of the flora and fauna of both east and west. Thus it is that the presence of two species of Duiker antelope, not found, I think, elsewhere in Eastern Africa, and of the mountain gorilla have now been remarked as far east as 30°. On my arrival in this area in 1919 I twice had hasty glimpses, high up in the Birunga forests, of a small and curiously marked antelope. It was apparently unknown to natives of the plain. I made every effort to obtain a specimen, but every man's hand seemed deliberately against my hunting, and I did not then know the few forest tracks very well. I could not even elicit recognition of the existence of any such animal, far less a name from the local natives. Later, on picking up something of the language, I overheard the word *Impuyi* used in connection with our fruitless hunting. With this as a basis I made some progress and found it to be the name of the animal in question, and thus eventually managed to shoot one at the edge of the Kinkizi forest north-east of lake Mutanda. None of the natives of Kenya and Uganda at that time in the district had seen or heard of it before. Identification of the skin in London proved it to be a *Cephalopus sylvicultor*, or yellow-backed Duiker. The explanation of the natives' obstruction to hunting was that the animal is one of the three clan-totems of Msinga, Sultan of Ruanda, and, as such, a forbidden beast which no native of Ruanda would either touch or willingly permit any one else to harm.

The red Duiker, *Cephalopus rubidus*, is locally known as *infumbiri*, and is common in the thickets of Rukiga. It extends as far east as the high country overlooking the Kazinga channel connecting lakes Edward and George, and probably on the western side of Ruwenzori. It has, like other West African fauna found here, developed physical

characteristics suitable to its peculiar environment and to the difference between extremes of heat and cold. It is distinctly longer in the hoof, horn, and hair than is generally the case.

Regarding gorilla: In March 1919, when at about the 13,000-feet level on Mount Muhavura, resting and sheltering before attempting the final climb to the summit from the south-east, I saw emerge from a thicket of hagenia trees and lobelia, a considerable distance below me, two large hairy heads. The bodies were hidden by a group of rocks. The chest of the one which was the more visible was black and bare. I thought them to be two pygmies who had followed the unusual intruder into their privileged hunting grounds, as they frequently wear rough protruding caps of monkey-skin while hunting, though they seldom penetrate so high. An icy storm was bursting from the south-east with cutting snow. At the onset of the storm the heads moved down and away from me with the apparent intention of seeking the bamboo forest belt and the more protected side of the mountain. They rapidly crossed an open space, and I saw them to be enormous apes. The larger, which I judged to be the male, appeared to be over six feet in height, and of enormous girth. He was standing fairly erect, probably owing to the fact that he was supporting himself as he moved with his left hand upon the scattered rocks. They prepared to descend over a short cliff. At the edge the male appeared to assist the female with his right arm with an absurdly solicitous air, and they both disappeared. When I ran down to the edge and looked over I caught a glimpse of them below, disappearing into the bamboo on all-fours. No knowledge then existed as to the presence of gorilla in British territory. I knew moreover that the Duke of Mecklenburg's expedition of 1905 had failed to obtain confirmation of the presence of gorilla in the Birunga range, though they had discovered a new species of chimpanzi. Their failure incidentally was probably due very largely to the lack of knowledge of the distinctive native names of the chimpanzi and the gorilla. In the Swahili *lingua franca* of Eastern Africa there exists no special word for gorilla. The Swahili word for the largest ape translates into chimpanzi in English and into *impundu* in KinyaRuanda. The gorilla has in the Birunga a separate native name. It was only after endless inquiry that I elicited any information from the natives of this part, and finally obtained a specimen myself from less debatable ground in the Kayonsa Forest in north-west Rukiga nearly on 30° E. long. I am inclined to think that this is at present the only district within the Empire where gorilla are known to exist, and that this is probably both the highest altitude and the furthest east at which they have so far been found. I should add that it was only later, on receipt in England of my description of them, that I learned the animals to be gorilla. I did not then know of the specimen shot before the war by the German von Beringer in the Eastern Congo. I am anxious to record the fact that I have since learned that

my friend Major Critchley-Salmonson, lately Political Officer Kigezi, a keen and competent naturalist, had suspected, from certain spoor, the possibility of its existence in Kayonsa. In my subsequent march hence towards the west coast, I saw gorilla in the territory of Walikale and heard what I took to be gorilla in the equatorial forest at about 110 miles north-west of lake Kivu. I would add in conclusion that during the two years subsequent to this first encounter on Mount Muhavura, I lost no possible opportunity of observation and study of these interesting beasts in their own haunts. The lava caves of the Birunga forests offer unrivalled observation posts for this purpose. It has thus been possible to obtain a certain amount of information of their intimate habits, and to collect and identify many of the herbs and berries which form their staple diet. It was only at the end of two years, after the discovery of their identity and possibly new distribution, that any of these animals were killed by us, and then only one male and one female for scientific purposes, the skeletons now being in the British Museum. I owe a real debt of gratitude to Sir Sidney Harmer and the personnel of the Natural History Section for the sympathetic help and encouragement that I have always received from them. When it was decided that a definitely useful purpose would be served, a solitary family of gorilla was purposely selected to be sacrificed, and the young one of some three months old was brought up on my premises with a baby's bottle. It was a most affectionate and healthy little animal, but unfortunately it died of pneumonia after some months, despite its proper diet and every care. It is sincerely to be hoped that the Colonial Government will see its way to follow the example of the Belgian Government in placing these comparatively rare and scientifically valuable animals upon the prohibited schedule at the earliest possible moment.

Lion are also found on Mount Sabinio, whither they ascend from Ijomba and the upper Ruchuru valley. Gorilla have been known to kill lion when they have intruded upon their family groups. It is of interest to note the increase in numbers and boldness of lion in Eastern Africa of late. Very numerous are the reported cases of their entering townships in Western Uganda and the Tanganyika Territory in 1920–21.

Both buffalo and elephant are found high up in the mountain, as also the giant forest pig. The elephant spend the greater part of their time at above 9000 feet, and very seldom descend to the lava plain. They are very truculent and do not hesitate to approach human habitation. On two occasions when camped on the mountains at night only our guard fires induced a large herd to divide and pass each side. On one occasion in passing they tore away the guide ropes on the side of the tent furthest from the fire. The mountain buffalo on the other hand would appear to be a comparatively timid race. The elephant tracks provide useful (and indeed the only) paths for climbing the majority of the mountains. In the Behungi bamboo forest the elephant are far smaller, the

biggest seldom standing as much as 9 feet high. On the other hand, when this herd was interrupting communications by destroying bridges and rest-camps in 1919, we shot the largest bull of the herd whose tusks showed the respectable weight of 50 and 50½ lbs. They are hunted by the pygmy Batwa, who, in February 1921, drove down the herd as a parting fantasia across the Chuya glade to be photographed! Pygmy elephant driven by pygmy hunters—though it seems scarcely likely that the former will be found to be a new sub-species.

In the lava plain of the County of Bufumbira, hitherto known politically as British Ruanda, there is reason to believe in the possible existence of a large carnivorous cave-dwelling animal, unanimously described as blue-black in colour and a night hunter. It is known to natives by two alternate names and is much feared. It has never, they allege, been killed by them. It would be fruitless to enter here into a detailed description or unprofitable surmises. Continual hunting, by every possible device over a long period, produced no result, and it may merely prove to be a myth.

In lake Bunyonyi are duck, teal, tern, cormorant, and a kind of red-shank, while among the bracken fern on the steep lake-sides, as throughout Rukiga, are quail, francolin, and guinea-fowl. The Situtunga marsh antelope, Speke's tragelaphus, which exists in the Bunyonyi-Ruhuhuma papyrus in probably greater numbers than in any other part of the world, is very rapidly decreasing.

The bushbuck of west Bunyonyi varies extraordinarily in marking Some show a purely barred, others a purely spotted marking, and the animal, from being driven in some places to live more in low swampy ground, has a tendency sometimes to revert to the Situtunga type.

A new species of clawless otter has been found in lake Bunyonyi. Of necessity it has not been a fish-eater. It is a swamp-dweller whose principal diet is frogs and eggs. It is an inveterate robber of ducks' nests, a fact which has appreciably altered the habits of these duck in the nesting season. There are no crocodiles in any of the Ruanda lakes. There have been for some years an average of half a dozen hippopotami in lake Mutanda, two usually in lake Chahafi, and two in lake Kivu. In Mutanda they are kept down, as they are very fond of the local millet crops, which they destroy extensively.

The shores of lake Edward in British teritory are at present not accessible, except for those whose duty it is to inspect them, as they have been for many years included in a closed Sleeping Sickness area. Hippopotami are very numerous here, and extraordinarily curious in the closed part of the lake, where they are never molested. Their curiosity during several night journeys which we have had to make by canoe, was often most embarrassing. In the ponds of Kikeri, below the escarpment in the Edward plains, between the mouths of the Mchuera and Ntungwa are some dozen hippopotami, who will come up and approach when

called by the Muhororo native who styles himself in their language the "game-priest of the plains." Kigezi and Ruanda are not however in a general sense game countries.

It may be of interest to remark that in Ruanda, with particular reference to the Birunga region, the influence of the moon on animal and vegetable life is considered by the population to be a very potent factor. Apart for instance from the avoidance of the cutting of bamboo for building purposes in the fuller phase of the moon, the effects of the moon on the habits and even appearance of animals, especially the weasel and gorilla, is much insisted on.

In view of the fact that the peculiar geographic features of the country enter so largely into the lives and religion of the people, I may perhaps be permitted to touch shortly upon the local beliefs, which are not uninteresting. The Mwami or Sultan of Ruanda remains, with the exception of the Negus of Abyssinia, probably the most despotic and powerful ruler in Africa. He is assisted in his administration of the country by a state religion. The Sultan of Ruanda is in a sense a personification of the deity Imana. Thus he alone of all the Ruanda ranks and races makes use of no intermediary between the Deity and himself. The term BanyaRuanda comprises the three Ruanda races, the BaTwa Pygmy aborigines, the BaHutu negroid agriculturists, and the ruling caste of BaTutsi, a slim hamitic-looking pastoral people. The BaHutu or middle class are in the great majority. The BanyaRuanda practise an organized and unusually developed form of Monotheism administered by a pontiff and a hierarchy of Mbandwa or apotheosized heroes. No creature animate or inanimate is held to possess a spirit or soul save men. The spirit of man is believed to remain dormant and inoperative until after death. The ritual of the state religion, which shows curious elements of hypnotic suggestion, contains much that appears ridiculous but more that borders the sublime. The pontiff is the Liangombe, apotheosized hero-king, protector of mankind against malevolent spirits which approximate in character to the Jinn creation of Islam. At death the MnyaRuanda's spirit is conducted to Muhavura, the Sacred Mountain. Judgment by ordeal is passed by Binego the chief Mbandwa on behalf of the Liangombe, in the name of the Deity Imana. A spirit found to be that of a true and faithful initiate is made free of the unfailing cruse of wine, *Intango ya Liangombe*, and smokes the pipe of peace from the tobacco of the Elysian fields, which are guarded by a white bull and a white sheep, upon the mountain's upper slope. Spirits found to be of the profane or of evil livers are cast forth into the flames of Nyiragongo, whose smoke is clearly seen from the summit of Muhavura. On making an ascent of the mountain in March 1919 the *Intango* was found to be a small crater lake of dark but clear and icy water at about 13,000 feet near the eastern summit. The "tobacco" fields appeared to be of the giant Lobelia. The protestant Nabingi sect of north Ruanda and the eastern Congo is a late importa-

tion, an alien influence, popular and anarchic. It has been repeatedly suppressed by the Sultans of Ruanda as defenders of the faith, and has frequently been a serious menace to local European authorities—British, German, and Belgian. Female priestesses obtain considerable powers and sometimes terrorize whole districts. A number of interesting cases of sudden death, without apparently direct physical cause, following curses pronounced by priestesses of this society, have come under my personal observation. Early in 1915 the Anglo-Belgian fort of Chahafi was attacked at dawn by some two thousand fanatics under the fighting leader of the society. A letter from a native Agent in Kigezi dated as recently as October last states that "On the 22nd we captured a Nabingi priestess by name Mukegánira. She was inciting all the population to rebellion, giving out that 'We are going to rise and fight against the Europeans and their agents and drive them out.'"

Ethnologically as well as geographically, the Rukiga and Bufumbira counties of the Kigezi District of Uganda, like the Kissigali and Kibati divisions of the adjoining Kivu District, belong to the native Kingdom of Ruanda. It is, in my opinion, a pity that distant political considerations should have caused their severance. Again, in east Ruanda it is regrettable, from an ethnological and geographical standpoint, that the desirable provision of a territorial corridor for potential Cape to Cairo rail construction should, since the Treaty of Versailles, have necessitated the abandonment of an immemorial and natural boundary, namely the River Kagera (meaning itself *measurer* or *divider*) as the Anglo-Belgian frontier in what was once German East Africa. Dismemberment of compact native kingdoms between different European Governments is usually a source of friction and annoyance to both parties, and seldom in the interests of the natives themselves.

The BaChigga and BanyaRuanda natives of south Kigezi have been accustomed to look southward to Ruanda proper for their religious and social inspiration. The same applies to the BanyaRuanda of Ijomba and Kibati in the Congo district of Kivu. For some ten years the two parts and the whole have been pulled politically in three separate directions influenced respectively from London, Brussels, and Berlin. It is interesting to compare the superficial differences of administration. In Kigezi Ruanda, for instance, there is a poll-tax taken in shillings. In Kivu Ruanda it is a hut-tax collected in francs. In Ruanda it is a poll-tax payable in rupees. Land tenure, systems of justice, and development of means of transport are all equally divergent and in many cases actually contradictory as applied as in this case to the same race. There is a crying need for some correlation of system and collaboration of practice throughout the continent. In the area of the Belgian mandate considerable progress has been made in the construction of roads, the encouragement of trade, and the establishment of secular education for the sons of chiefs. The measures taken in common with ourselves in

1920–21 for the combating of rinderpest, which had been spreading towards Ruanda from the north through Uganda, were then, thanks to the practical goodwill of the respective veterinary services, both effectual and a model of co-operation. The danger to the immense cattle resources (the sole wealth) of Ruanda was economically very grave, and there was the further menace to Rhodesian ranches through Tanganyika. By improving communications between lakes Kivu and Tanganyika, the Belgian Government hopes to be able to create and foster a cattle trade between Ruanda and the Katanga mines to supplement the very meagre local resources. It is probable however that the German estimate of two and a half million cattle for the Province of Ruanda is a very considerable exaggeration. The export of Ruanda cattle through the forest westward to the Congo River is considered, probably correctly, to be impossible owing to several zones of tsetse fly. It is indeed a pity, since (in 1921 at least) beef was practically unobtainable in Stanleyville. It is perhaps however worth mentioning in this respect that during two and a half months of the march westward, through the equatorial forest, none of the sheep and goats, which were taken from Ruanda with my caravan, died from disease. In fact some eventually arrived on the lower Lualaba Congo in good condition.

The BaChigga tribesmen of Kigezi and Ruanda who at their harvest-home after the gathering of the sorghum crop, which they use for the making of beer and porridge, indulge in wild drinking orgies, often lasting three or four nights and days and accompanied by a species of Dionysiac rites. Murders at this period are frequent, and as, in the case of Kigezi, every part of the district is within a night's journey from some part of an unadministered or foreign territory, these light-hearted murderers usually escape betimes, profiting by the endless feuds among the turbulent frontier clans to cross the border. The natives complain bitterly that, if a murderer is caught and handed over to European justice, the process of judgment and confirmation by a High Court some 300 miles away is so slow as to lose much of its deterrent effect when eventually carried out. It is thus that on two recent occasions where really wanton murder was committed the natives have, by consent of the elders of the clan sitting in council, administered a prompt and public punishment on the spot according to their tribal custom. The victim was in one case the murderer's stepfather, and in the other his mother-in-law. The murderer was caught, brought back to the scene of his crime, and confronted with the body, with which he was shut up during that night after being sentenced to death. The prisoner was given all he asked for in the way of food. The elders met again before dawn and confirmed their decision. At daybreak a deep grave was dug. This was beneath the threshold of the victim's house. The murderer was then brought out and stripped of all his ornaments and of his clothing, which in these parts consists of a tanned ox-hide. He was then securely

tied up and placed face upwards at the bottom of the grave. The body of the murdered person was then placed upon the top of him, in the presence of the young men of the clan who were summoned to be present as a warning for their future conduct. The grave was then filled in on both of them. The elders would, in their estimation, be putting themselves in the wrong by taking human life under these circumstances with their own hands, the very thing which their action is intended to discourage. They were pained and surprised when the Government not unnaturally felt forced to take strong action in the matter. The murdered man in these cases is considered thus to have killed his murderer. It is very largely due to the sympathetic tact and energy of Captain Persse, Assistant Commissioner in Kigezi, who was in charge of frontier patrols during 1920, that border feuds and murders have enormously diminished, and these troubled zones have come at last to learn some of the arts of peace. Captain Persse, who is a Fellow of this Society, has done a good deal of work in supplementing the map of the Birunga region.

Arable land in Rukiga is barely sufficient for the needs of the people, and is everywhere intensively cultivated. The bare and treeless mountain ridges and uncultivatable lands are everywhere used for pasturage. The mountain buttresses are seamed up to the summit with clear, straight cattle tracks. The numerous and well-determined valleys of Rukiga seem a series of self-contained compartments, and thus have lent themselves to the establishment and continuance of the system by which each valley or hill is occupied solely by a solid block of people consisting each of a different clan. There are few places in the world where the aboriginal clan system of man can be more advantageously studied. They do not admit or understand the private ownership of land, which is held by the tribe sub-divided into the clan, for the benefit of the family or community. They consider land, as the birds, the water, and the air, to be the attributes of Mother Earth to provide a sufficiency for the direct maintenance of all.

Taking its equatorial position into consideration, the climate of Ruanda is generally, for a tropical country, extremely good. In the Chingogo Mountains there is not infrequently a frost, and at the Kabale post in Kigezi, where the hill is 7000 feet, as low as 3° above freezing has been registered on several occasions. It is however worthy of remark that the majority of the personnel of the White Fathers Algerian Mission on lake Kivu have found by experience the wisdom if not the necessity of taking a daily dose of quinine as a prophylactic against malarial fever. Moreover illness and casualties among Belgian officials in the Ruanda have been unexpectedly high during these first seven years of their occupation. The richness of the soil in Ruanda, outside the lava regions, which are very limited, has been much exaggerated. Representatives of large ranching firms who are interested in meat extract and similar undertakings, have visited the country and pronounced against it as a centre of activity for themselves, neither the quality nor

quantity of cattle apparently answering to their expectations or requirements.

The mountainous district of Kigezi is situated in an isolated position at the furthest corner of British Eastern Africa. On the north it is bounded by a closed Sleeping Sickness area round Lake Edward; on the west by the Belgian Congo; on the south by the ex-German Colony under Belgian mandate; and to the south-east, below the escarpment, by the hot and sparsely populated plains of Rushenyi. It is only to the north-east that there is a window, so to speak, opening on to British territory. The British officer in charge of Kigezi frequently finds himself in very close relations with his Belgian colleagues, who administer a kindred population from posts geographically nearer to Kigezi than any British one. I cannot do less than record my great indebtedness to the District Commissioner of Kivu and to the Resident of Ruanda for their practical assistance in troublous times, and for the fact that their invariable welcome in Belgian and mandated territories enabled me to make thorough and repeated examination of those of the Birunga volcanoes that lie within their respective districts.

Before the paper the PRESIDENT said: This evening we are to have from Captain Philipps a description of a little-known part of the world tucked away in the heart of Africa. Captain Philipps has described this country to me as one of the most fascinating parts of the world which he has ever been in, both from the point of view of natural beauty and from the interest of the human element which is found there and of the fauna and flora. And Captain Philipps should be a good judge, for there are few parts of the continent of Africa in which he has not travelled, and indeed few parts of the continent of Europe either. He regrets that many of the slides which have been prepared from a number of photographs which he has taken are not available this evening because, unfortunately, as far as I can gather, they are marooned somewhere near Constantinople. But, fortunately, he has a certain number which will help to give us an idea of the beauty of the scenery. I now have great pleasure in calling upon Captain Philipps to give us his paper.

Captain Philipps then read the paper printed above, and a discussion followed.

Mons. POL LE TELLIER (Counsellor of the Belgian Embassy): I am very grateful to the Royal Geographical Society for giving me the pleasure of listening to Captain Philipps' paper. It has been most interesting to me, and I am glad to know that he has such a good opinion of my compatriots in Ruanda. I know that he, on his part, left in Ruanda the very best of memories, and I can assure Captain Philipps that we believe that he has contributed very much to the betterment of that part of Africa which we try to do our best to develop. I am proud to have this opportunity of congratulating Captain Philipps on his work generally, and on what he has done for Ruanda in particular. Many of those whom I am addressing have travelled a great deal more than I have—indeed, I feel as a pygmy before you—and have seen and experienced so much that they are better able than I am to appreciate the work which is done by your Society. For twenty-five years past I have known the Royal Geographical Society, and there are few of its publications which I have not read. I have

always taken a great interest in the work it has done; it appeals to me in that it deals with countries where we imagine all kinds of wonders to exist. At the same time we know also that there are realities to be faced by those who visit little-known parts of the world. This Society does not deceive us about that, but it encourages the exploration of those places, and interests the younger ones among us who are seeking excitement in life, so that they go to unknown parts and end by becoming pioneers of civilization. Captain Philipps is a real pioneer of civilization, and I am sure he will use all his energy and his knowledge for the uplifting of Africa.

You know as well as I—in fact, better than I, because you are specialists and I am only a diplomatist—the difficulties that were encountered in the early days of the development of the Congo. We had to feel our way and we may perhaps have made some mistakes; but we were helped by flashes of genius and the great spirit of enterprise and sacrifice that was shown. We also had our great pioneers. Remembering all this and our hard work, tenacity, and courage, it was with great pride that we saw the British and the Belgian soldiers shoulder to shoulder in the Congo. That is something which will not be forgotten, and it is the foundation of a great hope that in the future we shall always work well together, and that if we have little troubles we shall, nevertheless, settle them amicably and do all we can to help each other. We Belgian people regard you as the "elder ones," and though sometimes it is thought that the latter are those who know too much, at the same time we have great respect for your knowledge. We see you as great examples and we mean to follow in your footsteps. I think you will agree with me that during the past ten years we have done a great deal in the Congo, and I am very glad to say that it is largely because we have improved our knowledge by your experience, and that we have always endeavoured to follow your good example.

Colonel JACK: There are many points in Captain Philipps' paper on which I should like to comment, but as the hour is late I will be brief. His photographs and eloquent description have brought back to me very vivid recollections of a most interesting and fascinating country in which I spent a very happy period of my life. In adopting the name Birunga for the range I would like to express the hope that the name Mufumbiro will not be lost sight of, because it has many historical associations. It was used by Speke and Stanley, and has formed the subject of discussion in many official documents. I should like to add my expression of regret as to the necessity for dividing up the Sultanate of Ruanda. It amounts to the dismemberment of that country, and is a matter for the greatest regret. No doubt the reasons were cogent, but I am afraid it must be acknowledged that when native interests conflict with European, the former have very little chance. Captain Philipps made very brief mention of the cult of Nabingi. That is a very interesting subject. Nabingi is a female spirit which inhabits some man or woman, and for the time it occupies that man or woman the individual wields tremendous influence in the country and is very often a source of terror to the neighbourhood for miles around. There have been numerous manifestations of the Nabingi spirit. When our Commission was in this country a woman called Muhumusa gave a great deal of trouble, and was finally captured by a detachment of the King's African Rifles under Captain Reid and she is now in captivity. I learnt from Captain Philipps that this woman was a manifestation of Nabingi. The curious thing is that the fact that possession by the spirit gives no immunity from capture or from death does not seem to affect the prestige of the spirit at all. When one of those who is possessed of Nabingi is captured or killed it makes no difference to Nabingi or to the natives; she simply nips off and inhabits

some one else and carries on as usual—this makes the problem very difficult. I have had the opportunity of reading a paper on the subject by Captain Philipps, and there is no doubt that this Nabingi cult is a very serious thing and a real danger. It is difficult to know how it is to be coped with. In conclusion, I should like to express my great appreciation of Captain Philipps' very interesting and valuable paper.

Major R. E. CRITCHLEY-SALMONSON: I have only been able to detect one inaccuracy in Captain Philipps' speech, and that was the statement that I was a competent naturalist. However, he has endeavoured to disarm criticism by calling me his friend, so I will content myself, in retaliation, with telling a very short story of the early days of our friendship.

It was very early in the war. Captain Philipps was in charge of about ten men, watching the mouth of the Kagera river, and I happened to be commanding the Southern Frontier of Uganda. I had been sitting up all night writing orders, when at about 6.30 a.m. a frantic messenger appeared with a chit which read: "The war drum on Igoma beach is sounding. This signifies the Germans have crossed the Kagera and are advancing. I am going to offer the first resistance." I thought, "Poor Philipps; that's the end of him." Then—and I trust my military superiors will approve—having done all I could and being very tired, I went to bed. A few hours afterwards another messenger arrived from Captain Philipps, and when I opened the note I saw it was headed "Igoma Beach" and read: "I arrived here and found that the chief in charge of the drum had got drunk and, in his excitement, had beaten the drum. I am now doing the same to him!"

Turning from the personality of the lecturer to the equally attractive subject of his paper, I would refer, first of all, to the eruption in December 1912, which Sir Alfred Sharpe so graphically described, as he saw it, from the west. I think I was the only European who saw it from the east. I was returning to Kigezi Post and had spent the day by the Ruhuhuma Swamp. Leaving the swamp at about six in the evening, as we breasted the rise we saw all the western sky lit up, and naturally thought of grass fires, but these were dismissed as impossible in the circumstances. When we finally got to the top of the ridge, above the lava plains, we had a wonderful view of the new crater in eruption. I moved from there to Kigezi and ultimately to the foot of Muhavura, and thence back through Kumba to Mbarara. On arriving at the latter place, and whilst waiting for the officer from whom I was to take over, I was surprised to hear what I took to be blasting. When he came I asked him about it, and in reply he said: "That is not blasting; it is the volcano." "But," I said, "I have just come from the volcano and it is not making a sound." "Well," he said, "it is the volcano, and it has been going on for the past ten days." It is rather an interesting phenomenon, and one of which I have never obtained a satisfactory explanation, that at no point on the road from the foot of Muhavura to Mbarara was there a sound audible, notwithstanding that at certain points I was on the hilltops with nothing between me and the volcano, and at others in the valleys, and yet at Mbarara the noise made by the eruption was clearly to be heard. Incidentally I should remark that the distance in a straight line from the foot of Muhavura to the new volcano is approximately 30 miles, while from Mbarara it is about 120 miles.

With regard to gorilla: my observations were made in the Kayonsa forest. On the first occasion, in 1912, Captain Reid, whose subaltern I was in those days, actually saw a large animal close to him in the forest. I heard a roar and, coming up, found Captain Reid extremely annoyed with his orderly

who had handed him an empty rifle, with which he had had a snap. From his description and the spoor and from observations made on subsequent occasions and after much discussion with my orderly, who was a Congolese and knew how to differentiate between gorilla and chimpanzi, I was sufficiently convinced that they were gorilla to put in the chapter on Kigezi, which I wrote for the Uganda Handbook in 1913, that they would probably be found in this district. I am naturally well pleased that this somewhat bold prediction has been fulfilled, for at the time none of us were aware that gorilla had been found anywhere in the vicinity of the Birunga volcanoes.

With regard to Situtunga, there is one point. Captain Philipps drew attention to its decrease in the Ruhuhuma Swamp. I hope he has not given the impression that there has been a general decrease throughout the country, because in reality it is very plentiful. Its decrease in the Ruhuhuma Swamp is not due, I am glad to say, to Europeans, but to indiscriminate hunting by natives with dogs and nets, at all seasons of the year. That it is not much affected by Europeans is, I think, proved by the fact that Situtunga are still found within a quarter of an hour's walk of the cantonment at Bombo, where a whole generation of sporting subalterns has pursued them more or less in vain. The Ruhuhuma Swamp is the only place I know where one can see them feeding out in the open at any time of the day, and I have seen as many as twenty at a time. It would be a pity if they were allowed to be killed off there.

Captain Philipps referred to hippopotami in the Kikeri Pools. I once saw thirty-nine there in a small area of water about 100 yards by 150 yards: the largest number I have seen together anywhere.

Turning to the question of the tribes, and passing over the Batwa and Bahutu, I noticed that Captain Philipps was not brave enough to hazard any theory as to the origin of the Batusi other than that contained in the story of Luganzu, which I hardly think we can accept as true! Colonel Jack remarks that they are "supposed to be of Galla origin," while Sir Alfred Sharpe states that they were at some long time past immigrants from the far north-east, possibly Abyssinia, Gallaland, or Somaliland. That they are recognized, even by other natives of Africa, as having an affinity with the north-east is shown by a story I was once told. A European took a Somali with him to Ruanda, and a proud Mtusi said to the latter one day, "Why, we are of the same race." Said the still prouder Somali, "On the contrary, you are clearly a Galla dog," which showed that even he recognized the resemblance.

Incidentally, with regard to these migratory movements, the tendency still exists and has only been checked by the settlement and partition of Africa. For instance, in the Northern Frontier district of Kenya, the Somalis even now are always pressing south-west, to better lands, and, had it not been for our intervention, Boran, Rendile, and Samburu would probably now be south on the Uaso Nyiro.

Reverting to their origin, I believe I remember reading a tentative suggestion of Sir Harry Johnston's connecting them with the descendants of the Hyksos. In this connection I would mention the interesting earthworks on the banks of the Katonga river. These earthworks are a number of miles in extent, covering what was probably once an open waterway, and with observation posts on promontories running down into the Katonga. When I was discussing them with a settler who knew them well and was much interested in them, he put the question to me, "Who were the greatest earthwork makers?" and the answer of course was, "The Romans." "Well," he said, "years ago two

Gaulish Legions revolted in Egypt and marched away to the south and were never heard of again." The inference is rather fascinating!

A small point as to depopulation. This, I think, was also due to a famine as well as to disease and Batwa raids, and when I first went out there, as Colonel Jack will remember, not only the shores of lake Bunyonyi but even Kumba was much depopulated. With reference to the Batwa raids: Going along the Emisi one day, I remember asking the natives why they built their grain stores right down in the swamp, and they said, "It is because of the Batwa." "But," I said, "they have eyes; they can see them as well as I can." "Yes," they answered, "it is not that. But when they come to steal the grain we can lie up in the swamp and spear them as they pass." The fact being that they did not dare to face the little semi-pygmy people in the open.

Captain Philipps made the country out to be rather inaccessible. I think I can understand his reason and sympathize with it! On the other hand, there is no doubt that sooner or later it must be more developed. It is quite true that most of the suitable country is occupied and required by the natives, and it will be very difficult to find land for European settlement, but I think it essential that a few should be allowed in. Captain Philipps was wise, however, in sounding a warning note, and any premature and unduly extensive attempts to open it up are to be deprecated. In any case we want to ensure that any Europeans who go in are those who mean to develop the country and not those who will simply hold it for speculative purposes.

In conclusion, there *was* one other slight inaccuracy in Captain Philipps' speech to which I wish to draw attention. He stated that there does not exist any English-KinyaRuanda interpreter. In actual fact, as we have all gathered to-night, there is just one—the lecturer himself. I think you will agree with me that it is very largely owing to this qualification, coupled with his profound and sympathetic understanding of the native, that Captain Philipps' memory will probably outlive that of all other Europeans in this land of the Nile Springs and the Elysian fields.

The PRESIDENT: In conveying to Captain Philipps an expression of your gratitude for his lecture to-night, it is hardly necessary for me, I think, to lay stress upon the fact that he is a man of great versatility. His paper has shown that he is not merely an administrator and a geographer but he is also an anthropologist, a zoologist, and a chemist. He has the water of rivers and lakes analysed; he stocks fishless lakes with fish; he creates zoological gardens; and he carefully studies the habits of the animals he places there. But there is something else he does that he has not told you. From these out-of-the-way corners of the Earth which he frequents he writes postcards to the Secretary of the Royal Geographical Society and sends them off by different routes, adding strict injunctions to the Secretary that he should take careful notes as to the times at which the postcards arrive, his object being that he may discover the shortest postal route from these out-of-the-way districts to the great Metropolis of this Empire. Captain Philipps has given us a most interesting and admirable paper this evening, one which I am sure has given the greatest pleasure to all those who have been fortunate enough to hear it.

SIR HARRY JOHNSTON sends the following note as a contribution to this discussion:

It is nearly twenty-three years since I travelled to the verge of this region on the north, in days when the extension of German, Belgian, and British influence was an unsettled question. One of my objects in approaching

Ruanda was to get what had not then been made, a record of its remarkable language. I wrote it down from the accounts of a party of BanyaRuanda who had come to consult me regarding the political position of their country. Subsequently this remarkable Bantu speech was effectively studied and described by Père Eugène Hurel in vol. xiv. of the *Mitt. d. Seminars f. Oriental. Sprachen*, published in 1911, and numerous other studies of Ruanda and the closely allied dialects of Rundi and Ra or Tutsi were published chiefly in the *Mitt. d. Seminars f. Oriental. Sprachen* between 1909 and 1914. The Ruanda language is one of the most—but not *the* most—archaic of Bantu languages. I cannot however agree with Captain Philipps in describing it as "probably the most difficult" of the two hundred and twenty-six Bantu languages. It is very elaborate, but its pronunciation is melodious and simple, and it has few irregularities or exceptions to rule. It is easier to learn than Zulu-Kafir or Sechuana, or some of the tongues of south-east or south-west Bantu Africa. It is allied more especially to the languages of Bunyoro, Toro, Ankole, Karagwe, Kerebe, and the southern shores of the Victoria Nyanza, the north-east coast of Tanganyika, and Buganda and Busoga; and less directly to the speech-forms on the north-east and east of the Victoria Lake.

The gorilla, I should like to add, is not only found (I have seen photographs of newly killed specimens) at comparatively low levels of 2000 to 3000 feet in the Congo forest, east of the Stanley Falls of the Upper Congo, but markedly in a gigantic form north and south of lake Kivu at altitudes between 9000 and 12,000 feet. George Grenfell killed a gorilla—one of four whom he saw—a short distance north of the northern bend of the Congo, to the west of the Aruwimi confluence. There were wandering legends among the Basoga and Baganda, twenty odd years ago, of an ape bigger than the chimpanzi having once existed in the forests of Buganda and Busoga.

H. H. JOHNSTON.

THE INFLUENCE OF MAN AS AN AGENT IN GEOGRAPHICAL CHANGE

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THE boundary of Geography is difficult to define; it overlaps many sciences and in particular Geology. The present tendency seems to be to concentrate on the human side of the subject, and much is being written on the effect on man of local characteristics of the Earth's surface, or we may put it the effect of Nature on Man. It is remarkable that the effect of Man on Nature seems to be almost entirely ignored. A certain amount has been written on the effect of irrigation, deforestation, tillage, etc., on climate, but, so far as I have been able to discover, the only work dealing with the many aspects of the subject is a book by G. P. Marsh, which under different titles attained to three editions. The last one, entitled 'The Earth as Modified by Human Action,' appeared in 1877 and has long been out of print. Marsh's book is full of information, but is scarcely scientific in treatment, and about half the work is devoted

to the effect on climate of the destruction of forests. Sir Charles Lucas, in his Presidential Address to Section E of the British Association in 1914, gave an outline of the subject, and Mr. H. M. Cadell has treated the Firth of Forth from this point of view.

The effect of Man on Nature falls readily into two parts, the effect on Animate and on Inanimate Nature. I have tried to give a comprehensive view of the effect on Inanimate Nature in a book recently published entitled 'Man as a Geological Agent,' considering in particular Great Britain. Quite recently J. Ritchie ('The Influence of Man on Animal Life in Scotland,' 8vo, Cantab., 1920) has described the effect of Man on Animate Nature in Scotland. Here I shall confine my attention to the other half of the subject.

Probably the most important way in which man modifies nature is by mining and quarrying rock, thereby greatly assisting natural agents of denudation, besides transforming the scenery. A somewhat elaborate calculation of the quantity of rock removed by man in the various kinds of excavation leads to the conclusion that, in the case of Great Britain, it is of the order of 40,000 million cubic yards since the earliest times. Of this approximately half has been excavated at the surface and the other half has been mined.

The 20,000 million cubic yards obtained by mining causes subsidence of the surface and modifies the drainage system.

Spread over the whole area of Great Britain and Ireland uniformly, the total excavation would amount to 3·83 inches, or, if we suppose it to be concentrated on that part of Great Britain south of the Firths of Forth and Clyde, the excavated layer would be 7·12 inches in thickness. If we compare this figure with Sir A. Geikie's ('Text-Book of Geology,' 4th edit., 1903, p. 591) estimate of the rate of denudation by erosion in the British Isles, which is 2·72 inches in 2000 years, and remembering that by far the greater part of human excavation took place during the last century, we see that, in a densely populated country, man is about five times as effective as a denuding agent as all natural agents combined—a somewhat unexpected conclusion.

A very important effect of mining operations is the subsidence of the surface. Although subsidence has been the cause of lawsuits in this country since the fifteenth century, little is known with certainty, even yet, of the laws of subsidence. It is remarkable that theories of the laws of subsidence vary in different countries; thus there are Austrian, French, and English schools. The main point of contention amongst engineers is, whether or not there is a certain depth below which mining does not disturb the surface. Sometimes, where solid rocks overlie the mine, they break, owing to lack of support, and in so doing occupy more space than before. Consequently, if the mine is sufficiently deep seated, the broken and packed rock above may fill the void and the surface remain unaffected. If, on the other hand, the strata above the mine are soft

rocks, such as shale or mudstone, it is believed that they sink bodily without appreciable breaking and let the surface down even though the mine be very deep.

The effect of leaving pillars to support the roof of a mine is undoubtedly to delay subsidence, but unless the pillars are very large it does not prevent it permanently. The pillars have to support a greater weight than when they formed part of a solid bed, and they are exposed to the weathering action of water that floods the mine when disused. In many cases where pillars have been left the ground subsides in a patchy manner, leaving a hummocky surface.

A subsided area is usually concave in the centre and somewhat convex at the edges. It will usually be shallower than the height of the mine and more extensive than the area mined.

It is possible to prevent subsidence by stowing waste materials in the cavities produced. The stowage of waste rock will reduce the size of the cavity considerably and thereby diminish subsidence, but will not altogether prevent it. But by packing the cavities with sand or ashes, under hydraulic pressure, it is possible to fill the void and prevent subsidence entirely, or at least reduce it very greatly. Over a hundred collieries in Upper Silesia have used the method, and it has been employed also in other countries. In Britain it has been used at Motherwell, and on a small scale at Crowgarth Iron-mine, Cumberland. In the latter case hæmatite lies below a small town at a moderate depth.

The most remarkable cases of subsidence are seen where salt is the mineral worked. The towns of Northwich, Winsford, and Droitwich are all notorious for subsidence. Several circumstances render subsidence due to salt excessive in Britain. One is that the salt-beds are far thicker than coalseams, also that the mineral is entirely removed, except for some impurity, and there are no pillars to support the roof. Further, the salt-beds are much nearer the surface than the average workable coalseam, and finally the strata above the salt are, except in the Middlesbrough district, clays, and sand and gravel.

At Northwich the rock-salt consists of two beds, each reaching a maximum thickness of about 90 feet, though the top bed is usually much thinner than this. Originally the top bed, which is from 140 to 180 feet from the surface, was mined for rock-salt, pillars being left to support the roof. Later the lower bed was discovered and all new mines opened were in it. Bad mining was responsible in some cases for collapse of the roofs, the causes being (1) insufficient size of the pillars left to support the roof, the pillars in the bottom bed being the same size as those used in the top bed, although the weight to be supported was much greater; (2) water was not kept out with sufficient care, the result being that pillars were eaten into at their bases. The collapse of a mine in the bottom beds was very serious, for it caused the top bed mines above to collapse and allowed water to enter and flood the mines. One collapse

HIGH ROAD FROM NORTHWICH TO WARRINGTON

SUBSIDENCE EAST OF NORTHWICH

By permission of G. W. Malcolm, Esq.

HILL OF BURNT SHALE, PUMPHERSTON OIL WORKS, NEAR EDINBURGH

DELABOLE SLATE QUARRY, CORNWALL

By permission of Geological Survey.

led to another, until at the present time there are very few mines left dry.

The destruction of the rock-salt mines revolutionized the salt industry. It became necessary to pump the brine from the flooded mines and evaporate it in pans, and now nearly all the salt on the market is made in this manner. The subsidence produced in Cheshire is very serious. In a town the effects are readily seen, but in the country a considerable subsidence may pass unnoticed. The most considerable effect is the production of lakes called "flashes." These are constantly growing; small lakes unite to form larger lakes and the depth also increases. The flashes, when sounded, are found to have stepped sides and are often 30 or 40 feet deep, but some are much more than this. Ashton's Flash at Northwich had a maximum depth of 110 feet in 1896. After several hundred thousand tons of sandstone, excavated when making Liverpool docks, had been thrown into the lake and a great quantity of dredgings from the Weaver spread over the floor, in all 1½ million tons of waste materials, the depth had decreased to a maximum of 50 feet in 1902, but by 1906 it had once more increased to the original figure of 110 feet.

Subsidences began at Winsford only in 1820, but there are now three lakes, the largest being about three-quarters of a mile long and with a maximum width of about 340 yards. While at Northwich the lakes are over the sites of collapsed mines, and are therefore not related to the rivers, at Winsford the lakes are strung along the river Weaver.

The total output of salt from Cheshire, up to the end of 1913, was about 71½ million cubic yards, and it is being taken away at the rate of about 450,000 cubic yards annually (figures for 1913). The lakes are still growing, and will continue to do so as long as the brine is pumped. If we look forward many centuries to a time when the whole of the salt has been removed, we may expect to find an area of about 200 square miles reduced in altitude by nearly 100 feet. This would bring much of the country below sea-level and cause a great lake to form. It is difficult to imagine, however, that the salt will ever be entirely extracted.

At Middlesbrough the salt industry is a new one and the conditions are different from those in Cheshire. The salt-bed is thinner, the depth greater, and the superincumbent rock more massive than in Cheshire. So far subsidence has not been felt, but there are indications that it is about to become noticeable, and once started it will become more marked as the brine is pumped. The Middlesbrough salt-field is very little raised above the sea, and a small subsidence would bring in the sea over a large area. On the other hand there is an enormous and growing accumulation of slag from the iron furnaces which could be used to neutralize the subsidence.

Subsidences have appeared in other salt-fields, but on a small scale proportionate to the smaller outputs.

Mention has been made of the use of the Northwich lakes as dumping

grounds for rock excavated at Liverpool and the dredgings from the river Weaver. We may add to these the ashes from the salt-works, and the waste, mainly carbonate of lime, from the chemical works. This is an instance of the complexity of man's interference with nature and how accumulation goes on concurrently with excavation. Up and down the country there are gigantic mounds composed of the waste from coal and other mines, or the waste products of industries. Much of the waste is dumped in the nearest disused excavation and the surface made continuous once more. The larger quarries, however, seem to be permanent, and so of course are such excavations as railway cuttings. Even some of these may eventually be filled in, should a change in the means of transport lead to the disuse of a railway or a canal. The case of St. George's Dock, Liverpool, is significant. This has been filled up in my own recollection and the site built over.

In many places there are no excavations conveniently situated for receiving the mass of waste produced, and the waste has to be disposed of either by throwing it into the sea, spreading it out on land, or by heaping it up in mounds. The first method can only be used near the coast, and the material may accumulate and add to the land area, or it may be washed away by the waves, or it may fall into deep water below wave action. Middlesbrough offers the best British instance of the reclamation of land by filling up the foreshore, and some 4270 acres have been, or are being, reclaimed in this manner. Some of the iron slag from furnaces at Workington is drifted along the coast and deposited as shingle on the south coast of Walney Island. Cases where the waste is dropped into deep water are at Stirling Hill quarries, Peterhead, and at Tintagel, Cornwall. Whether the material remains at the foot of the cliffs in deep water or is swept away by currents is not known.

Where masses of waste accumulate on land they form hills of characteristic shape. Whether the material be waste from a coal-pit, slag from a furnace, or dust-bin refuse, there is much in common in the outline of the artificial hill produced. The waste is usually tipped at the end of a tramline, or railway line, and forms a sloping bank the inclination of which is the angle of repose for the material. The angle will differ with the size of the fragments. The result is, in the first stage, a long and narrow spit of land bounded on three sides by slopes of the angle proper to the material. The spit soon becomes inconveniently long, and usually others are started alongside. So the mound grows in width and the flat top increases in area. Frequently it happens that, to avoid destruction of valuable land, the tram or railway line is raised and more waste deposited on the first-formed flat, and this is sometimes repeated several times until the mound may be as much as 200 feet in height. Always, however, there is a flat top, which at the limit would become a point, while the slopes have the angle of repose of the material, unless of course some obstacle, such as a wall, holds up the waste. In nature the nearest

approach in shape is seen in volcanic ash cones and in mesas. Where the flat top is small and the outline of the mound is rounded, there is a resemblance to a volcanic cone, but where the top flat is large the resemblance to a mesa becomes marked.

Where the material is deposited on low-lying land, as in a stream valley, the artificial terrace resembles in outline a river-terrace. Examples may be seen near most industrial towns.

It is to be remembered, when viewing a district such as the Black Country of Staffordshire, that although to all appearances man has raised the surface-level by dumping an enormous mass of waste, which elsewhere ('Man as a Geological Agent,' p. 206) I have estimated at 230½ million cubic yards, spread over an area of 22⅛ square miles, that is to say a mass larger than was excavated from the Panama Canal, yet the waste is derived from the coal and ironstone dug from below and is of less bulk than the cavities excavated beneath. As a fact the ground level has been lowered, subsidence more than counterbalancing the gain from the débris. This is easily proved by examining the numerous canals of the district, which serve as levels. There are cases where a canal was originally in a cutting but is now on an embankment, owing to subsidence of the surrounding area. Under the tunnel on the canal at Netherton the coal has been left, but it has been got on both sides. As a result the tunnel is now in a ridge rising abruptly on the western side 40 feet, thereby showing subsidence to that extent. Subsidence still continues in the district and is a constant source of expense, because of the frequent loss of gas and water from fractured pipe-lines.

It sometimes happens that the waste is sufficiently fine in texture to be moved by the wind, and it then forms æolian deposits. The fine dust may be blown out of the district and spread over ground a long way off, where it will, as a rule, be lost in the natural soil. At other times it forms sand-dunes. Good illustrations are said to occur near Johannesburg and Kimberley, where the waste from the gold and diamond industries, respectively, becomes subject to æolian action. Apart from the waste of industries there is a constant accumulation of débris round every centre of population. I have taken the case of London as an example, because of the size of the place, but on a smaller scale the same process of accumulation continues under, and around, every town.

Elsewhere ('Man as a Geological Agent,' p. 169) I have estimated the amount of excavation under the site of London at 50 million cubic yards, but this does not affect the surface of the area greatly, because subsidence is prevented by lining the underground hollows with brick or concrete; while only a small fraction of the material excavated has been dumped on the surface, the remainder having been transported right out of the area.

Since the Middle Ages London seems to have been thought of as

the Great City, vastly larger than any other town in the country, just as it is now, even though in the reign of King John the population was probably only from 30,000 to 40,000. In early days houses were built largely of wood, with a thatched roof and plastered sides. Naturally destructive fires were common; the Great Fire was merely the latest of a series. Laws were enacted ordering houses to be built of stone to a height of 16 feet, and roofs to be of tiles, shingle boards, or lead, and in course of time these laws seem to have had some effect.

In these early days all waste accumulated round the houses, whether house refuse, the waste of industries, or the ashes of buildings. Near the town there would be excavations for gravel, or brick earth, and these holes when disused would naturally be filled up with the town's refuse, and the filled-up ground gradually built over. Meantime more pits would be opened up beyond, these in turn being filled up and built over. In addition waste was thrown into the street and trampled underfoot, and on this accumulation the town rose higher and higher. During the construction of the Metropolitan Sewers sections were made across London, and the details are given by Mr. Whitaker ("Geology of London," *Mem. Geol. Surv.*, vol. ii, 1889). The thickness of the waste or "made ground," as it is convenient to call it, varies greatly over London; thus at High Street, Shoreditch, it is but $4\frac{1}{3}$ feet in thickness; while at the junction of Old Street and Goswell Road it is $19\frac{3}{4}$ feet. In some cases these variations are doubtless due to the filling of old excavations, in others to natural hollows in the ground, as, for instance, the valley of the Wall Brook, which has yielded Roman remains at the depth of 30 feet. There is, however, another reason for variations in thickness. The oldest parts of London stand on the thickest accumulation of débris. Thus, we get the thickest mass under the old Roman City, and the mass thins as we leave this centre until we approach another ancient town, such as Westminster, where there is an increase that is roughly proportional to the antiquity of the place. It would seem that a rough estimate of the growth in height of London on its own débris would be one foot per century, a figure which I am informed applies to accumulations on the sites of ancient Eastern cities. Most of the brick earth under London was dug out for bricks, thereby lowering the surface, but as the bricks made were used up near by, and they eventually decayed, or were destroyed by fire, or rebuilding operations, their débris remained to fill up the hollows left by the brickmaker.

Another source of material for made ground is house refuse. Much of this is organic, but it contains a proportion of inorganic constituents, and these are left behind when the organic matter decays. Such materials as scraps of food, leather, or clothing would add something permanent to the mass after decomposition, and fragments of metal and earthenware would also be present. Iron decays, but it is probable that the rust remains as a cement binding the other constituents. Another

ingredient that must not be overlooked is the ash from fires. At first this would be from wood, later coal was imported, and the ashes were thrown out of the house, usually into the street. I have estimated ('Man as a Geological Agent,' p. 181) the coal used in London from the year 1600 to 1912 at 846 million tons, and we may say 850 million tons from the earliest times to 1912. At the moderate estimate of 5 per cent. of ash this has yielded 4½ million tons of rubbish which has probably gone directly, or indirectly, into London made ground. By indirectly I mean that much of it was used in stock-bricks, and the bricks were built into London houses and eventually incorporated in the made ground.

Until 1815 all sewage was entirely, and until 1847 partially, retained in cesspits, and towards the end of this period parts of the ground under London were honeycombed with cesspits. Further, in 1907, to mention a gruesome subject, 50,000 persons were buried in spaces not exceeding 203 acres in extent (H. Jephson, 'The Sanitary Evolution of London,' 1907, p. 18). There must also have been accumulation from these causes.

Until about 1885 London bricks were of the "stockbrick" type. These were made in the Sittingbourne, Southall, and Slough districts. London dustbin waste was sent to these places in barges, and, after weathering and picking, the finer parts were mixed with clay and kneaded into bricks, while the half-burnt cinders were used to start the kilns. The organic matter in the bricks completed the burning. When modern man began to complain of the smell, coke replaced dustbin refuse, and the waste was either taken down the Thames to be dumped in the estuary, or disposed of locally. An increasing amount is burnt in destructors and the inorganic remains are cast into flagstones. These, *e.g.* at Walham Green Station, sometimes show nails, boot heels, etc., set in the stone and brilliantly polished by attrition. The artificial flags are used up locally, and when worn out help to make road foundations. Once again local waste accumulates in local "made ground."

London illustrates very well another way in which man disturbs nature. The original drainage of the site of London has been put into sewers. The Thames itself has been greatly modified by man. Originally the river was bordered by extensive marshes, now filled up and built over. The first stone London Bridge was completed in 1209 and lasted until 1810. It formed a great obstruction to the tides, but served one useful purpose in holding up the water above the bridge 4½ to 5 feet at low and 1½ feet at high tide; so helping traffic above the bridge. A great deal of dredging has been done since the old bridge was removed, but, according to Mr. Greaves (in J. B. Redman, 'The River Thames,' *Proc. Inst Civ. Eng.*, 49, 1877), the ballast collected by Tyne colliers for their return journeys had, by 1877, exceeded the mass of material dredged since 1810. Much of the ballast was thrown into the sea by

the colliers, but great mounds of it accumulated on the banks of the Tyne and some of these still remain.

The Thames was navigable from above the old bridge as far as Richmond, but between Richmond and Reading there was a series of obstructions. Barges had a draught of only 3 feet 9 inches, but even then they could only pass shoals by the aid of flashes from numerous weirs and locks.

The new bridge offers much less obstruction to the tides than did the old one. Also the embankments have filled up much of the area flooded at high tides. The age of the Essex embankments is not known. They exclude tidal water from 30 square miles of land, and Mr. Redman (*op. cit.*) estimated that they are responsible for a difference in tidal level of 5 feet between Sheerness and London. The modern embankments have added to the effect, it is believed, to the extent of 4 inches as far up as Teddington.

There does not seem to be any river in this country that has not been modified by man. The Tyne, for example, when Queen Victoria came to the throne, was a tortuous shallow stream full of sandbanks, which men could ford at Newcastle. In 1838 dredging commenced, and between 1838 and 1894 some 95 million tons were removed and deposited in the sea. The result was that, by 1895, a 5000-ton vessel could pass up the river to Elswick. Bill Point, a cliff 72 feet high projecting into midstream, had been cut back 400 feet, the excavation amounting to 2 million tons of soil and rock.

Similarly, the Clyde, which used to have 3 to 6 feet of water, has now 24 feet. It may be said that the Clyde and Tyne are almost as artificial as is the Manchester Ship Canal. To a greater or less extent every river has been altered. The increasing demand for water for drinking, power, and factory use has already profoundly modified the natural circulation of water. By pumping, the water-table is lowered, causing rivers to lose some of their supplies. This is particularly well marked on the outcrops of the Chalk and the Bunter, for on the one hand they are the chief sources of underground drinking-water, and on the other hand they are very pervious formations and the rain-water sinks through with considerable freedom. Mr. Urban A. Smith stated in evidence before the Royal Commission on Metropolitan Water Supply (Appendix, 1893, p. 390), that, during the twenty years ending 1893, the source of the River Ver had retreated downstream 5 or 6 miles, the Gade 2 miles, the Chess 2 miles, the Bulbourne 1½ miles, and other streams by similar amounts. It appears that one of the Chiltern Wind Gaps, about the age of which so much has been written, namely that of Tring, contained a stream in historic times.

Similar results are to be noticed in the Sherwood Forest country, where heavy pumping is now in progress.

Pumping must lead to increased circulation of underground water.

This is most obvious in the salt-mining areas, for practically all the subsidence noticed there has happened since man began to pump brine. Left to nature the underground water became brine in contact with salt, but remained almost stagnant, the only loss of salt being by upward diffusion, an extremely slow process. The drinking-water obtained by pumping, in this country, is probably about 400 million gallons daily. In addition there is the water pumped from mines to keep them dry, as well as the brine already referred to. We may estimate the weight of water pumped from mines as, on the average, about twelve times the weight of mineral raised. This would give the quantity of water pumped from coal-mines alone, in 1913, as 1746 million tons. The removal of so large a quantity would have an appreciable effect on underground circulation. Over a considerable part of Britain the water is collected into reservoirs, whether for drinking, for power, factory use, or to supply canal locks.

The proportion of Britain from which the drainage is collected is considerable, but has not yet been accurately measured. I have put on a map of England and Wales all the collecting areas I could discover, but the map is far from complete. Prof. A. Henry (' Forests, Woods and Trees in Relation to Hygiene,' London, 1919) has published some sketch-maps of collecting areas for town supplies. Drinking-water and power-supply areas are of course confined to wild places, but the water is collected from much cultivated and low-lying land to supply canal locks. The maps in the Report of the Royal Commission on Canals and Waterways show this instructively. One finds that in the case of such a river as the Colne, flowing through cultivated land, the whole basin is divided into a large number of small areas which pour their water into the Grand Junction Canal, and only after having been used in locks does the water reach the river. The circulation of water is greatly modified in this manner over much of England and Wales.

We have seen that the streams that formerly flowed over the site of London into the Thames have been put into sewers. The 117 square miles covered by London is therefore deprived of its natural rain supply, as this flows directly off the artificial surfaces into the sewers. About 1 per cent. of England and Wales is covered by roads (' Man as a Geological Agent,' p. 110), and probably an equal area is prevented from receiving rain by buildings ; consequently some 2 per cent. of the country must be deducted from the catchment areas of rivers.

The pollution of streams is another important interference with nature. The Reports of the Royal Commission on Pollution, in 1870–1, are very interesting and they resulted in considerable improvements, but pollution is by no means a thing of the past, as a walk round a Lancashire industrial town will show. Apart from the question of nuisance and the destruction of fish, pollution must have a very important bearing on denudation and the deposition of sediment. There are conflicting factors involved,

and the subject is worthy of careful research. For instance, does the precipitation produced by salts in solution overcome the opposite action of colloidal impurities? On the answer depends our estimate of geological time, as found by studying the materials carried to the sea by rivers. The only rivers studied are all in a more or less unnatural condition.

The effect of reservoirs in holding up floods and doling out compensation water in dry seasons will be to lessen erosion, but the bulk of erosion takes place above reservoirs.

Destruction of forests tends to produce floods and so promote erosion. This action is now well known and it will not be described here. Every brook and ditch show an interference with natural circulation and Mr. Lamplugh has described some of these problems in his paper on the "Taming of Streams" (*Geographical Journal*, June 1914).

A study of Man's activities leads to the conclusion that his works resemble those of ice more than any other natural agent. If we compare Man's results with those of the Quaternary Ice Age, we find that both denude to a considerable extent by abrasion and remove not only weathered but also unweathered rock; the accumulations of both, on the one hand "made ground," on the other boulder clay, have much in common. The scenery produced by both has also points of resemblance; thus lakes are formed by both, also quarries have a general resemblance to glacially formed corries, while glacially cut channels and artificial cuttings are also not infrequently much alike.

It has been possible in the present paper to mention only a few ways in which Man has modified geographical conditions. The destruction and protection of sea-coasts, reclamation of lands, effects on climate, must be left untouched. In 'Man as a Geological Agent' I have endeavoured to give an outline of Man's action on inanimate nature from all points of view. The statistics given are regarded merely as a first approximation to the truth. They are of very unequal value, but everything must have a beginning, and if they lead critics to investigate and produce more accurate figures they will have served a useful purpose. There is a large and untrodden field for research, and the subject is essentially geographical as well as geological.

Before the paper the CHAIRMAN (Lord Edward Gleichen) said: Dr. Sherlock has very kindly come here to-day in order to give us a lecture on what I think ought to prove a most interesting subject, "The Influence of Man as an Agent in Geographical Change." I do not think I need do anything further than introduce Dr. Sherlock to the audience and ask him to give us the lecture.

Dr. Sherlock then read the paper printed above, and a discussion followed.

Mr. G. W. LAMPLUGH: The subject that Dr. Sherlock has brought before us is already one of particular interest to geographers, and will in the future be of even greater interest. There has never before been a creature on the Earth exercising the kind of activity that man is exercising. His whole career has

been for a very short geological time, and of that time only the last few hundred years have been of consequence in this matter, because his earlier agency did not amount to much more in this country than leaving a few flint implements in the ground. Now he has got vigorously to work, and, with accelerating velocity, is altering the surface in all kinds of ways, some strikingly conspicuous, others not so conspicuous. If man's activities are to continue through a moderate geological period, running, say, into hundreds of thousands or a million or so of years, he will leave the surface of the Earth very different from what it was when he started. Dr. Sherlock has shown the many ways in which man is conspicuously modifying the surface, and has given particular value to his investigations by reducing the results to figures. Previously we had merely a qualitative idea, and the attempt to replace this quantitively is extremely interesting. Of course he submits his figures as approximate and tentative, but they bring out one thing which is very striking: that, in a closely settled country like our own, man is already doing much more in the shifting of inert matter than all the natural agencies combined.

There is, however, one factor only referred to in passing by Dr. Sherlock which is incalculable, but may amount to more than all the factors that have entered into his calculations, and that is, the effect of man as an agriculturist. In any country with a moist climate the surface is naturally covered with forest, bush, or prairie. When man comes along and breaks up the ground he sets up a new regimen of denudation. The rain before fell upon the vegetation and filtered down gradually; it had no impact. But on cultivated lands there is an impact of the raindrops upon the actual soil, tending to carry it down any slope towards the lowest level. Any one who has surveyed cultivated lands will remember how, at every green balk or fence at right angles to a slope, the arrestment of the down-travelling material has quickly brought about quite a bold feature by steepening the slope on the down-side and flattening it on the up-side. That is just an example of what is taking place all over cultivated country, and the aggregate result may be perhaps the largest factor of man's influence in modifying the surface.

Dr. Sherlock's analogy between the results of the Glacial period and of man's activities is very suggestive, and it is true that both have tended on the whole to reduce and smooth the surface. Any country that man inhabits for a long time will, I think, eventually be a smoother, softer country than it was originally.

In referring to the influence of man on streams Dr. Sherlock mentioned some brief notes on the subject which I published some years ago in the *Geographical Journal*. It has reminded me that since then, in dipping into Gibbon's 'Decline and Fall of the Roman Empire,' I came across a passage which shows how fully the great historian appreciated this influence. It is introduced in discussing the effect of the Tiber at Rome, and is so apt and so characteristic of its author that I shall venture to quote it now. Gibbon says: "The servitude of rivers is the noblest and most important victory which man has obtained over the licentiousness of Nature" (an excellent phrase!), "and if such were the ravages of the Tyber under a firm and active government, what could oppose or who could enumerate the injuries of the city after the fall of the Western Empire?"

We have been considering this afternoon the many ways in which man has obtained a victory over the "licentiousness of Nature."

The CHAIRMAN: Dr. Evans was to have been here, but unfortunately he had to go away. He would have been most interested in this paper. Dr. Evans,

however, made a few notes on the subject, and I will ask Mr. Hinks to give them to us.

Mr. HINKS: The point, Sir, which Dr. Evans makes is much the same as that which Mr. Lamplugh has raised. The influence of man, in Dr. Evans' mind, has been of incalculable importance in the "periodical exposure, as the result of ploughing and other agricultural operations, of a large portion of the surface of the land to the sub-aerial agencies—variations of temperature, frost, wind, and running water. This, with the removal of forests and swamps and improved drainage, must have caused a very considerable increase in land erosion, especially in country that is at all hilly. The solid material carried seaward by the streams and rivers must be far greater now than it was before man took a hand in the operations of nature."

I should like, if I may, to add one remark to that. In talking over this matter with Dr. Sherlock this morning it occurred to me to mention to him that there was one thing that he had not dealt with and which I think is not covered by Mr. Lamplugh's remarks. He spoke of the effective action of the rain in striking on the bare soil and carrying it down. But I take it that there is also another way in which man proceeds to carve down the hills, and that is merely by the operation of ploughing. Apart from the rain, surely, in the ploughing of a hill there must always be a tendency for the disturbed ground to fall a little.

One is always interested in questions of surveying and desirous of seeing these things even more accurately measured than Dr. Sherlock has been able to measure them so far, and it occurs to me to ask a distinguished officer of the Ordnance Survey how, in his opinion, these subjects could be studied in England by methods of survey. We have now a new primary levelling of England which, of course, has made it its aim to set up accurate bench-marks along the line of ground that is least liable to be disturbed. I gather that it has probably avoided Northwich altogether. But in order to see how much—say one inch a year or two inches a century, or whatever it may be—agricultural operations are degrading the hills, it seems to me that the Ordnance Survey wants to put into effect some system of testing heights in suitable places, and I think it would be very interesting if Colonel Winterbotham, if you would call upon him, Sir, would indicate how in his opinion, the Ordnance Survey might contribute to this very important question.

Colonel WINTERBOTHAM: I am afraid, Sir, that I have been too interested in the lecture to collect my thoughts on an investigation of subsidence by spirit-levelling, but I should think it could be done perfectly well. I am sure that the Surveyor-General of the Ordnance Survey would be very interested in taking the necessary steps if they are financially possible. Quite obviously they are technically possible. The Ordnance Survey has just completed its great geodetic levelling, the fundamental bench-marks of which go down to solid rock. I am not quite sure how many of these fundamental bench-marks there are, but they afford datums all over the country from which precise measurement can at any time be extended and renewed. It does not seem to me that there would be any particular difficulty about making measurements of altitude with the precision, shall we say, of one-hundredth part of an inch of various points in constant agricultural use, and I take it that that would answer the question. The variations are very small. We are told something of the order of one to two inches in a hundred years. Is not that so?

Mr. HINKS: I should have thought it would be much more likely to be one inch a year in ground continually under plough.

Colonel WINTERBOTHAM: Then they should be very easily established. There is no question about that. In areas where there is a good deal of subsidence, in those rather dismal-looking no-man's lands of industry, pictures of which we have seen this afternoon, it would be much more difficult, because we should have to carry our levels a good long way from the fundamental bench-marks which avoid those very areas. It would be much easier, therefore, to find the effect in agricultural land than in places near industrial towns.

Mr. BROMEHEAD: I have listened with very great interest to Dr. Sherlock's paper; what perhaps interested me most was the part about London. There he is rather working on parallel lines to some of the work I have done myself. One little point to which he referred was the question of cesspits. A few years ago I was called to look at a section in Fetter Lane which had puzzled the archæological authorities from the British Museum who had seen it, and at first puzzled me and one or two other geologists. There were what one might call a series of basins, one inside the other, of which one saw the concentric semicircular sections in the ground. Each had its own date; there was a late Roman circle, and inside that came traces of Saxon occupation; then there was a Norman and a mediæval, and a whole series of datable strata resembling basins one inside the other. It seemed impossible to account for them. When, however, we got to the bottom of the hole the explanation was fairly obvious. In Roman times that had been a rubbish or cesspit, and later Roman people who wished to build a villa naturally filled up the hole. But all the while the organic material in the refuse, to which Dr. Sherlock referred, was being removed in solution. Consequently their levelling gradually fell in and lined the sides of the hole. The next people who wished to build there levelled it up again, and as the organic material was gradually removed from underneath, every successive filling in of that hole formed a new basin and was filled in again in its turn. Thus that extraordinary section was formed.

London affords instances of a number of the points Dr. Sherlock made. He mentioned the disappearance of the Wall Brook Valley, which is very nearly complete, and he spoke of such things as railway cuttings occupying natural channels. Most people would say, if they went about a mile westwards from this house, that they would come to a railway cutting at Addison Road Station. As a matter of fact they would not. They would come to a railway in the valley of the Counters Creek. The railway is laid over what was the original bed of the stream in a steep-sided valley.

There is another curious instance not very far away from us. The railway between Pangbourne and Goring on the Great Western Main Line goes through what most people call a deep cutting in chalk. I must confess I have been through that cutting in trains at least a hundred times without ever suspecting that it was anything else. But when Professor Hawkins drew my attention to it and showed me the old maps of the ground I realized at once it was nothing of the kind. It is not a railway cutting at all; it is a perfectly natural overflow channel, presumably glacial. Anyway, that cutting is natural and was there long before railways were thought of. It is quite a curious point and one which will cause a lot of searching of heart amongst geologists if we are to find a glacial overflow channel in the middle of the Goring Gap.

Another point. It is all very well for a man to interfere with Nature in this way and all very well for Dr. Sherlock to tell us how man does it. Occasionally, however, Nature gets her own back. *Naturam expellas furca tamen usque recurret.* There is an instance brought to my mind. When I was surveying the ground some years ago not very far from Maidenhead there was a place

called Ruscombe Lake which was, as far as I remember, several square miles in extent; formerly it was a wide marshy area of useless ground. There was a stream flowing into it which eventually, after going through the marsh, found its way to the Loddon and thence into the Thames. To drain that marsh man made an artificial channel for the stream and led it into another little stream flowing into the Thames near Bray, thereby shortening the course of those waters on their route to the sea from 29 miles—the old route *viâ* the river Loddon, Wargrave, Henley, and Maidenhead—to 6 miles for the new course. That is simply a case of helping Nature in a piece of river capture that might have been expected to take place some few hundreds of thousands of years hence. The fall is about 50 feet. Of course, one gets the same fall in the new course, about 6 miles, but most of it is concentrated in the artificial channel, so we get natural denudation of the channel due to the rapid fall given to the water. The result has been very satisfactory. Ruscombe Lake is no longer a lake; it is a flourishing agricultural area. But the small stream into which the old one was diverted, the one that flows in near Bray, is much too small to accommodate the large influx of water, so that overflows its banks and one gets floods there instead of at Ruscombe. One has simply moved the flooded marshy area a few miles away. That is the only result. For the marsh that has disappeared a new one is forming somewhere else to teach us what a puny person man really is.

It might be rather interesting to point out a somewhat personal aspect of the matter. That work was finished a hundred years ago, within a few days, as far as I can remember. The local agricultural owners arranged to pay for it by a voluntary rate. The surveyor employed his son as contractor, and the grandson of the contractor is a Fellow of this Society and is still waiting to be paid for the work!

Mr. WILLIAM LUNN: I should like to mention one point which I think has an important influence on this matter and which has not been mentioned: the effect of the volumes of carbon and its compounds that are being discharged into the atmosphere. Of course this must make a big difference, not only in the climate itself but by the accumulation of impurities on vegetation and so on. I think this could also be taken into consideration.

Dr. SHERLOCK: Most of the questions have to do with the agricultural side of the subject. I did not deal with that because it is almost the only branch of the subject that has a literature. Marsh devoted the greater part of his well-known work to it. I dealt therefore with a part of the subject not treated elsewhere. The effect of agricultural operations must, of course, be very great, but it seems to me a very difficult thing to estimate by levelling. Soil works its way down a slope, but is deposited somewhere, and it would be necessary to consider an area large enough to contain both the area eroded and that of accumulation. There is also a good deal of æolian denudation on bare soils. Mr. Lamplugh will remember a place near Ollerton where the hedges between fields had five or six feet of sand banked against one side, all blown off the fields. I do not suppose that it would be impossible to estimate the loss of material through agricultural operations, but it would be very difficult. It would certainly be well worth investigating.

Mention has been made of the effect of the discharge of carbon dioxide into the atmosphere. That is an interesting subject which I have dealt with in a book of which the present paper is a partial synopsis. The question is a debatable one, but it seems that the effect would be to ameliorate the climate. Carbon dioxide is known to act as a kind of blanket, and according to some

geologists the removal of carbon from the atmosphere, first as carboniferous limestone and then as coal, was followed by a great glacial period, and, according to some geologists, notably Chamberlin of Chicago, this was a case of cause and effect. This is denied by other geologists, but, at all events, the carbon locked up in coal and in petroleum is being rapidly returned by man to the atmosphere. It is only temporarily removed again by growing forests, for when the trees decay or are burnt the carbon they contain is again liberated. Whether the sea is absorbing the extra carbon dioxide and forming it into limestone is another question. I have dealt with this complicated matter in the book.

The CHAIRMAN: We have had a very interesting discussion after a particularly instructive paper. I think it is one of the most interesting afternoon papers I have ever had the pleasure of listening to.

I would only add one small contribution on my own part. I remember particularly passing through the Castile Province in the north of Spain, some parts of which are now, as many of you know, almost barren desert. I happened to inquire the reason of this, and was told that as late as in the Middle Ages it was really quite a fertile country covered with cornfields, besides woods and forests. The Spaniards of those days found that many birds came out of the woods and ate of their corn, and being somewhat foolish, with very short-sighted logic they said, "The birds nest in the trees; therefore, if we cut down the trees there will not be any more birds." So they cut down all the trees, with the result that no more rain fell, the whole place dried up and is now practically a barren desert. That, I think, rather bears out some of the points raised here this afternoon.

I think I need do no more than present our hearty thanks in the usual way to Dr. Sherlock for the extremely interesting paper he has given us.

SOME DIFFICULTIES IN FLYING ROUND THE WORLD

Major W. T. Blake

Read at the Meeting of the Society, 26 February 1923.

THE climatic and geographical conditions in cross-country flights of any great magnitude present problems to the aerial navigator which are not so nearly apparent to the traveller upon the ground. These difficulties are all the more pronounced when the flight also becomes a fight against time.

On my attempt to fly round the world last year the first climatic difficulty which arose was in the Alps. On two occasions we tried to cross this mountain barrier from Lyons to Turin, but unfortunately the misty conditions which prevailed made it impossible to attempt the passage of the mountains with safety, and owing to the height of the mountain barrier it was not practicable to fly at such an altitude that we could clear them—indeed, our heavily loaded machine would probably not have climbed to the necessary altitude. This meant a détour of some hundreds of miles in order to reach Italy by flying round the

mountains instead of over them. Had we been able to cross the Alps direct from Lyons it is highly probable that the trouble which delayed us a month at Marseilles would not have occurred.

The open meadows of central France and the large vineyards of the south give place on the western coast of Italy to small cultivated areas, generally on the side of a mountain. From the French frontier to Spezia there is practically no spot where a forced landing could be brought off successfully, but below Spezia the level country gives excellent flying conditions, remarkably free from bumps.

The Apennines, on the contrary, set up severe air disturbances, and after flying as far as Naples in delightfully undisturbed air, we were thrown about very badly after getting into the mountains, and these disturbances continued on the eastern side of the Apennines towards the Adriatic. Indeed, the bumps near Foggia became so bad that we found it necessary to put out to sea and fly about a mile from the coast.

On leaving Naples, as Mount Vesuvius was in a mild state of eruption, we decided to see what effect its activities would have on the aeroplane, and after flying round the cone at a more or less respectful distance and seeing the scars left on the sides of the mountain by rivers of molten lava, we turned into the smoke with the intention of flying right over the crater at a height of about 300 feet from the summit. Immediately we entered the cloud everything else became perfectly invisible; the stench of sulphur, which is said to be non-existent in Vesuvius, was overpowering, and we were hardly able to breathe, whilst tears rolled down our faces. The machine swayed violently as though in a gusty wind, and suddenly, as we approached the centre of the crater, we were shot almost vertically upwards for a height of 400 feet and immediately afterwards dropped like a stone for nearly 600 feet.

After leaving Italy for Greece we saw a perfect inverted image of the Albanian Mountains floating about 9000 feet in the air. The mirage was in every way a counterpart of the mountains, with clouds beneath, the real range and the mirage appearing tip to tip with about 1000 feet separating them. I have never before seen anything like this whilst flying in any part of the world.

The Ionian Islands stretched beneath us in most fantastic shapes, and it is hard to imagine any places with more irregular outlines as seen from the air. The reputed beauty of these islands was not discernible from above, and apart from their variety of outline they were dull and uninteresting.

On turning east into the Gulf of Corinth, matters were, however, very different. To right and left range upon range of mountains rose from the ground, whilst snowy cloud-fields rolled about their peaks, in some cases huge ball-like masses rolling up the mountain side until they reached the top of the ridge, and then falling away for some little distance until they floated free. On the southern side of the gulf a number of

mountains were flat-topped and, from the point from which we viewed them, appeared suitable to land upon.

Whilst it had been remarkably calm flying up the gulf, as soon as we left the water to cross over the hills to Athens conditions changed entirely. We were severely bumped from place to place, our worst bump dropping us nearly 600 feet. The machine was not steady for an instant, swaying about in all directions, the disturbances being, I imagine, partly due to the configuration of the country (for we were flying up a mountain valley) and partly to the mid-day heat.

We left Greece to fly across the Mediterranean to Sollum on the Egyptian frontier, navigating by compass and bearing-plate. As the day was remarkably calm and I was unable to take drift observations of white-capped waves, and my instrument was not adapted for taking tail bearings (by far the most suitable method on a trip like this), I had to fire Very's lights directly astern, and from the smoke emitted calculate the drift of the machine as best I could. Luckily the wind was almost following, and I had only to allow about 3° for drift, so we had no difficulty in making Sollum dead ahead of us shortly after we sighted the African coast. The only disturbances of any sort encountered were when passing over Crete, which at its western extremity is one mass of serrated mountain peaks with apparently not a single level or fertile spot. Immediately on crossing the coast of Africa we began to feel bumps.

From Sollum to Aboukir we flew along the edge of the Libyan Desert a few miles from the sea. Away to the right the desert stretched out in every direction in a dun-coloured monotony. At several points other than those indicated on the map it was possible to discern the traces of canals or walls, and occasionally the dim outline of what would appear to be buried buildings. All along this part of the desert are good landing grounds, and indeed it would be possible to bring a machine down safely on most parts of this country.

The lakes of the Nile Delta presented several curious appearances when viewed from above. The shallowness of the water was made more apparent by the large number of sandbanks, and the channels of deeper water through which the currents flow were plainly visible owing to their difference in colouring. Nearly all the lakes also had lying in the water objects in some cases a mile or more long looking like thin straight lines and ending in perfectly formed whorls. In some cases several of these whorls would arise from the same line. What these are I am unable to say.

Southern Palestine is not a good country for flying. The mountains, while not particularly high, cover the greater part of the country and are in addition strewn with huge boulders, which make landing dangerous if the engine should fail. It is also a district of bad air disturbances on account of the combined effect of the heat and hills. The real in-

significance of the muddy trickle of the winding Jordan is fully appreciated from the air, its waters appearing thoroughly earth coloured—a great contrast with the waters of the Dead Sea with its white shores glistening in the sun with salt deposits.

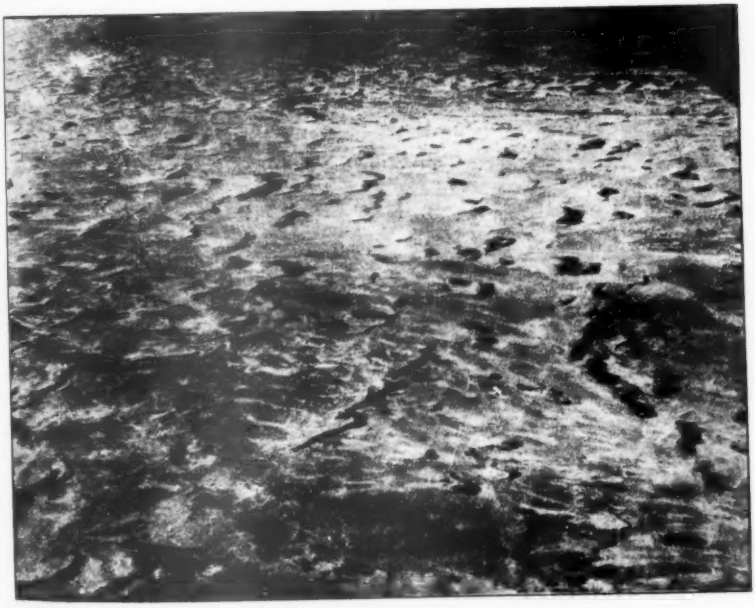
The Arabian Desert presented problems entirely of its own. We started from Ziza—about 30 miles south of Amman and the same distance east of the Red Sea—which consists simply of a tank constructed about two thousand years ago by the Romans (that has now become the watering-place of Arabs for miles around) and a few mud huts. Here the desert is flat and sandy, covered with fine gravel, but in the distance to the east it commences to rise in a series of low hills, beyond which lies the oasis of Kasr Azrak. About here the country alters its appearance and becomes covered with masses of basalt rocks interspersed with huge level mud flats, in some cases several miles across. From the air the desert, which remains comparatively level, looks like an immense nutmeg-grater. The mud flats themselves are of the colour of yellow ochre and glisten brightly in the sun. Indeed, the reflection of light is so strong as to dazzle the pilot and make it hard to estimate the distance from the ground, so that landing on them is not an easy matter. Apart from this they form excellent aerodromes, as their surface is level and smooth though cracked in every direction by the heat. These mud flats are generally surrounded by more low hills rising to 100 feet, or at the outside 200 feet, and sometimes even lower.

Later on the desert again changes its character and becomes undulating, covered with a rather coarse gravel, though the stones are rounded and frequently smooth. A little later one comes to a belt of loam, then to a place of thinly scattered basalt boulders, gradually changing into sand before the huge dark bitumen pools, a few miles west of the river Euphrates, are picked up.

The crossing of the desert was accomplished by following the track of motor cars made a year or so ago. At a height of 1000 feet from the ground the track was invisible, even in its best places, and over the hard basalt country it is impossible to see the marks left by the wheels. An aeroplane follows the track, so that help may reach the machine in case of a forced landing; it has therefore to fly low, with the result that the heat from the desert is at its worst and the machine is thrown about in all directions. An additional discomfort is the glare from the ground, which is extremely trying to one's eyes even when flying at 1000 feet and wearing smoked goggles.

We found numbers of insects in these wastes, and it would be extremely interesting to me to know on what they exist. On the mud flats huge clouds of apparently ordinary house flies appeared from nowhere. Once we were nearly 200 miles from the nearest known habitation, and yet we had not been there two minutes before we were all covered with dense swarms of flies. In other places were large yellow spiders, black scorpions,

MOUNTAINS OF PALESTINE AND SHORES OF THE DEAD SEA



THE ARABIAN DESERT

A MONSOON STORM IN INDIA

BAGHDAD

and centipedes about 6 inches long. Once we flew over three animals, which were startled by the machine and bolted for the same hole, arriving at the entrance together and fighting to get it. I am told they were probably jackals, but from our altitude of a few hundred feet they appeared to be considerably larger than this and more of the wolf type.

Only twice did we see any sign of human life in the desert: once when we landed near the wells of El Jid and were hospitably entertained by the Arabs, and once when we flew over an encampment in a dried-up wadi, when the people scattered in all directions and fired at us until we were out of range.

Mesopotamia was not an interesting country to fly over, particularly as the ground was only dimly visible through the dust-storms. As far as the eye could see the place was covered with spiralling dust devils, and at the height at which we were flying, some 7000 feet, the air was full of sand which appeared to continue for some thousands of feet above us.

The Persian Gulf was comparatively uninteresting as far as Bushire, the land near the coast being flat, with mountain ranges rising further inland; but after Bushire, and the whole way along the coast of Persia and the Mekran coast to Karachi, the most wonderful rock formations appeared. In some places parallel ridges of mountains ran right down to the seashore; between the ranges were sandy plains, making suitable places for a forced landing. The rock formations were often extremely curious, exactly as though they were the ruins of old cities. In some cases one could distinguish broad streets and blocks of stone-built houses, and even the details of windows and doors appeared to be visible. Along the Mekran coast in many places oil oozed out of the sands into the water.

Except for one thunderstorm in the south of France, we did not see any rain until shortly before reaching Karachi, when we ran into a thin drizzle on the edge of the monsoon area. Through India, however, we received the full benefit of the torrential downpours. India, in fact, seemed to me from the air to have only two types of country—the uninteresting expanse of the dreary Sind Desert and the flooded green plains of Northern India. The only rocky country over which we passed was on our flight up to Quetta, though at Ambala we saw the foothills of the Himalaya in the distance.

At Quetta, some 6500 feet above sea-level, we encountered difficulty in taking off, due to the high temperature and also to the altitude. During the heat of the day it was impossible to get our machine off even after a run of about half a mile and after two of us had climbed out and all the stores had been landed. This problem is one which necessitates a special type of machine for use in hot countries. The moist heat caused our wing fabric to rot, whilst the rubber connections melted off in flakes, blocking the petrol pipes and filters. The wooden framework of the machine was distorted owing to the heat and moisture; the propeller

laminations separated owing to the heat, and the propeller edges were broken by the terrific downpours of rain through which we flew. The worst downpour which we encountered was at Agra, when we flew through a storm which deposited 5 inches of rain in six hours. This stripped all the fabric off the propeller and ate big pieces of wood out of the blades, entirely spoiling the air-screw. At the same place a new air-screw was partly eaten by white ants.

From the air one could see the huge areas which were flooded by the monsoon rains. In many places villages would stand in a lake, and the position of roads was frequently only marked by the straight line of trees bordering them on either side. It was impossible to judge whereabouts were the normal banks of the Indus owing to the immense tracts of flooded country on either side.

The storms themselves were often local, and after flying in clear air one could distinguish the clouds ahead, and frequently by making a détour we were able to reach our destination without passing through rain, though terrific storms had occurred on the direct route. The cloud scenery was frequently terrible and imposing.

Beyond India the problems which were to confront us were chiefly the typhoons of the China Seas, the fogs and storms of the Aleutian Islands, and the ice of the extreme Northern Atlantic Ocean. These, however, we did not encounter, though I hope to personally experience them in the future.

Before the paper the Chairman (Colonel Sir FRANCIS YOUNGHUSBAND) said: The lecture which had been announced for this evening cannot, unfortunately, be delivered, but Major Blake has very kindly undertaken to tell us of his adventurous flight to India. He was the leader of the party which undertook to fly round the world last year. Unfortunately, he had to have an operation for appendicitis at Calcutta, and his comrades came to grief in the Bay of Bengal, and so the idea had to be put off for the moment, but Major Blake entertains the hope of being able to carry out this great undertaking later on.

Major Blake then read the paper printed above.

Sir PERCY SYKES: I should like to tell one story about Bandar Abbas. The first aeroplane that flew over that part some months before Major Blake did, alarmed the inhabitants. They all firmly believed that the Day of Judgment had come, and turned out in vast numbers on to the plain and began confessing their sins, and, among other things, how they had cheated one another. They prayed very hard and confessed their sins in very loud tones. At last the aeroplane landed without doing them harm. Then they were in an awkward position, because they all knew how they had cheated one another. So they thought over the question for two or three days, and finally held a very solemn meeting. At it, they all swore that whatever they had said on that occasion was privileged.

The CHAIRMAN: I am sure you would all like me to thank Major Blake. It has been an exceedingly interesting evening. Listening to the lecture, we understood and appreciated all the difficulties which airmen have to encounter

on such a great enterprise as flying round the world. They did not succeed, but they got as far as Calcutta; and really, when you think of it, it is an extraordinary thing that men should be able to fly from England, across Europe, across the Arabian Desert, and across India to Calcutta. We understand now a little of the difficulties Major Blake had to encounter, even in European countries. But when we hear of their flight across the deserts and through monsoons, it is marvellous what men are able to do as a result of resource and enterprise. I am sure you will all like me to thank Major Blake very much, especially for coming to our help when we were in difficulties, and to wish him the greatest possible success. We trust he will finally get round the world and come again to give us an account of his journey.

GEOGRAPHY AND HISTORY IN A PHRYGO-PISIDIAN GLEN

Sir William Mitchell Ramsay

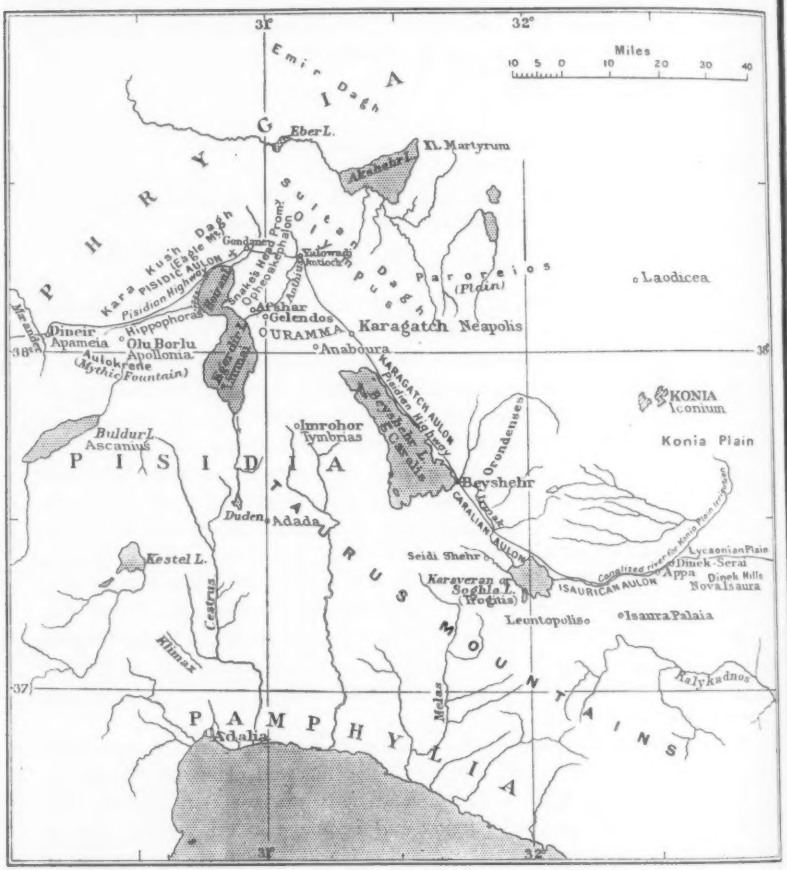
[*Note: The spelling of place-names in this paper has not been assimilated to the system of the P.C.G.N.*—Ed. *G.J.*]

GEOGRAPHY, the relations of land and water and the influence of climate, wind and health conditions, influence powerfully the history of mankind. This truth is not merely borne in on every person who attempts to understand the life of his own country and of the world generally; it governs the investigation of past history, as I shall illustrate by an example from Asia Minor. The main features of geography there rule its history now as they have done in the past. If we hope to restore a long-vanished prosperity, the past should be studied as a lesson for the future; and many tentatives and much error may be saved if those who have to reorganize the country know how the same problems were met and overcome in the creation of its ancient prosperity. The land which is now Asiatic Turkey was of old the wealthiest country in the world; and the conditions and causes on which this prosperity was founded have to be recreated.

I. I speak of a small district in the borderland between the mountains of Pisidian Taurus on the south and the hills and plains of Phrygia on the north, a singularly beautiful land. My purpose is not to describe the changes of race and religion and language in this district, but to picture the process of discovery step by step in the long ascent from utter ignorance to sure knowledge. The double lake of Egerdir (the ancient Limnai) lies against the Taurus mountains on the south. Along its north shore runs a great road, the Pisidian Highway, which has for ages carried intercourse between inner Asia and Europe;* it is the most

* It is described as the route of Xerxes in *Journal of Hellenic Studies*, 1920, p. 89. It is only a very recent discovery, having remained unnoticed as a great highway, though parts of it were familiar to all travellers. Mr. Ormerod described some interesting archaic pottery excavated on its course in 'J. H. S.' some years ago.

southerly of the three lines of communication across Asia Minor from east to west.* From the north-east corner of the Limnai this road ascends a pass, which for clearness' sake I shall call the Channel (αὐλών), anticipating the progress of discovery. Those three great lines of communication across Asia Minor have this one character in common, that the



Sketch-map to illustrate Sir William Ramsay's paper on a Phrygo-Pisidian Glen.

traveller, after starting on any of them, cannot easily diverge from the line which nature marks. Soldiers marching with baggage, when they once enter on the southern or Pisidian route 30 miles west of the Limnai, must go on past the double lake and through the Channel towards the East.

* The other two were the Central Trade Route, and the Northern or Royal Road north of Lake Tatta (*Hist Geogr. of Asia Minor*, p. 27 f. and p. 35 f.).

The district that forms our subject is defined by two ancient cities, Apollonia west and Pisidian Antioch east (Olu Borlu and Yalowadj). When in May 1882 I first traversed this part of the route from Apameia (Dineir) through Apollonia and Antioch and Karagatch going off towards Iconium, not a single ancient name was known on or near the 42 miles of road between those cities; hardly any scholar had ventured to place there any name even wrongly, or conjectured that any event of ancient history occurred there. Now we can put on the map a large number of ancient names, set bounds to nations and municipalities, and outline the history, especially as regards war, of this borderland through the centuries and even the millennia. Slowly through the work of forty years knowledge has grown.

(1) The Aulônes (Channels or Funnels) are a feature of the northern Pisidian frontier, lying below the Taurus, about 3300 to 3600 feet above the sea. Strabo alludes to them (xii. p. 569) when describing lake Trogitis, from which they stretched east and north. Those which lie on the Pisidian Highway alone concern us, and were probably the only ones which Strabo had in mind. The two most important are: (1) A cañon between Taurus on the south and the Isaurian hills (which pass north into the Orondian mountains) carries the overflow water of lakes Caralis and Trogitis to the plain of Konia. This passage for the water was blocked in the Middle Ages for a long time, but was re-opened for the Turkish government by a German group representing the Deutsche Bank shortly before the War; and the water was used to irrigate the plain of Konia. This was an old Turkish project, which I heard discussed by Said Pasha,* governor of Konia, in 1882, who had the levels taken to test the feasibility of the operation. This may be called the Isaurican Aulôn; Isaura Palaia lies on the front hills of Mount Taurus (which in this part does not rise so steep as usual from the Lycaonian country) at about five or six hours' distance south of the cañon, and Isaura Nova lies on the edge of a little glen among the hills near the eastern end, where the stream has entered the open plain of Konia.

The intention of the engineers † was to drain lake Trogitis entirely, and thus gain for agriculture a large tract of very fertile land. What has happened since 1914 is unknown. Thirty-five kilometres east of lake Trogitis a considerable stream flows down from the Isaurican hills into the Aulôn; and here the "Channel" or "Funnel" begins to open out into a wider and very rich valley among the hills, passing Appa and Appa-Serai, and reaching the open Lycaonian plain at Dinek-Serai

* Distinguished as "Ingleez Said": he had been educated as a Royal Engineer at Woolwich. He was in a sort of genteel exile as governor of the Konia Vilayet. The Sultan (who owed him the throne) did not venture to kill him.

† They were Swiss and Italian, hired by the German group and using Turkish labour (except where skilled work was needed, in which case Italian workmen were employed).

(which is about 3 miles west of Isaura Nova and 1 mile north of Dinek on the hills).

(2) The Caralian Aulôn carries the Irmak, which flows from lake Caralis (issuing at Bey-Shehr at the south-east corner of the lake) to Trogitis. It seems to be broader and more open than the other Aulônes; I have however never traversed it, but only passed the northern and southern ends. The modern canal takes off from the river (called simply Irmak) at a point 32 kilometres below lake Caralis, and is cut through the rich valley east of Trogitis. The Irmak flows into Trogitis east of Seidi-Shehr; but the plan was to drain it into the new canal, and dry up both lake Trogitis and the Irmak below the point where the canal branches off, opening for agriculture about 100,000 acres of very fertile soil.

(3) The Aulôn of Karagatch (Neapolis) is an opening among low rocky hills separating the valley of Neapolis or Anaboura from the land of the lake Caralis. It carries no stream, except perhaps after rain.

(4) The Pisidic Aulôn, the history of which is our subject, opens down westwards to the Limnai (Hoiran lake) at its north-east end, and slopes very gently up from the lake level (3025 feet).*

II. The beginning of knowledge here starts from military history. The Channel offers excellent opportunity for defence by offence, so that it must have been the scene of important events; yet during several years of study I found no allusion to it in ancient or mediæval history. At last, in reading the diaries of warrior pilgrims, who during the first three Crusades took part in those calamitous journeys across Asia Minor, I chanced on several detailed accounts of Barbarossa's great march in 1190 from the Dardanelles to the Cilician coast, where he perished in the waters of the river Kalykadnos, disappearing suddenly from view as he sat on horseback in the river directing the passage of his army. These simple pilgrim itineraries supplement one another, and furnish the clue to a tangled web of history, which Byzantine writers describe in unintelligible fashion.

Barbarossa had come by the great highway which ascends the valley of the Mæander, and had passed the historic city of Apameia-Kelainai, where two of the great lines of communication fork. He chose the southern or Pisidian route, which was the main road to the East during the twelfth century, for it led directly from the western sea to the Turkish capital Konia, and offered an easy pathway to armies.† The itineraries

* The "Pisidic Aulôn" is mentioned by Polyænus in his 'Stratagems in War,' iv. 6, 7. Polyænus, as is clear, got his information from Hieronymus of Cardia, who wrote the history of the wars in the time of Eumenes, his personal friend. Hieronymus had taken part in many of the events that he records, and seen the localities with the eyes of a soldier. A friend objects that Polyænus means only "an Aulôn in Pisidia." I have considered this point, and maintain my opinion.

† Only the western part of the route is here alluded to: the entire line is described briefly in 'J. H. S.,' *loc. cit.*

are so clear and detailed that the whole march through Phrygia from Laodicea eastward can be specified exactly day by day, almost hour by hour. Going on from Apamea-Kelainai, the army engaged in this third Crusade passed along the edge of the historic and mythic fountain of Aulokrene, leaving on their right the reedy lake where the goddess Athena of old invented the flute and the Phrygian music, and brought death to the Phrygian Marsyas.* A mile or two further on Barbarossa ascended the steep front of a step in the plateau, and from the summit followed the course of a little stream Hippophoras which flows eastward past Apollonia towards the double lake through a gradually widening glen with lofty mountains on both sides—on the right hand the outermost ridge of Pisidian Taurus, a long huge mass of bare rock about 7000 feet in height; on the left a lower ridge of the Phrygian type, tame, monotonous, and yet full of a certain charm which belongs to the Phrygian land (see 'H. G. A. M.,' p. 23 f.), and which affects one in the long run more deeply than the picturesque mountain scenery. The latter ridge, Kara-Kush-Dagh (Eagle Mountain) borders the road for 40 miles. The glen opens on the north-western end of the lake, which is shaped like an irregular sandglass, the northern part being the smaller, more quiet in scenery and yet sufficiently picturesque—surrounded by mountains, some nearer, some further away, varying in height from 5000 to 8000 feet above the sea, impressive in their infinite variety. Along this lake we take our way, and about the middle of the northern coast we look through the narrow opening of the double lake into the larger southern part, and observe its wonderful beauty as it lies amid and against the main mass of Taurus, fringed by some of the loftiest Pisidian mountains.

Now, standing on the north coast of the lake, one gathers a clear picture of the determining localities in front. We look 20 miles east to Olympus, which the Turks recognize as Sultan-Dagh, the Royal Mountain, Sultan of all lesser peaks around.† From the great peak at its north-western end a lofty ridge stretches south-east; but in our view it seems to run north to south, and closes the prospect before us, an impossible obstacle for an army. A little ahead the lake ends, and into it from north-east a small stream flows down through the Channel from the angle towards north-east where Olympus meets Eagle Mountain. The south side of the Channel is formed by a long ridge which seems to

* Alluded to in 'J. H. S.,' 1883, p. 69. Since then I have seen the spot where Athena, beholding her features mirrored in the lake, was horrified at her swollen cheeks, and threw away the flute with a curse on it. It is at the west end of the lake, beside the katabothra, or swallow-holes (duden), which carry down the water of the lake under the mountain, to emerge beside Apameia-Kelainai as the Mæander and the Marsyas.

† Opposite the Sultan-Dagh, towards east and north, is the lesser range of Emir-Dagh, a noble in the royal court. These names are instinct with creative feeling towards nature, and therefore are not originally Turkish, but translated from old Anatolian names. So in the case of Ai-Doghmush, Rising Moon ('J. H. S.,' 1918, p. 145).

run from the great peak of Olympus far out into the lake, forming a promontory called Snake's Head, Opheôskephalon, and dividing it into two unequal parts. These then are the fundamental features of the situation. The road to the east, by which alone it is possible for an army to march or trade to be carried, goes on up the Channel to Pisidian Antioch * and the east. On the right rises that long ridge 400 feet and more above the stream. On the left, or northern, side of the Channel low foothills slope backwards towards the Phrygian Eagle Mountain.

On those low hills, as well as in the Channel, the Turks were waiting while the Crusaders fought their way slowly up the Channel, in which they saw the forlorn and ominous traces of the appalling slaughter of the Emperor Manuel's great army, which had occurred there fourteen years before. In the open ground, as Barbarossa's troops emerged from the Channel, they inflicted a sharp defeat on part of the Turkish forces, but the main body of the Turks held too strong a position on the ridge over which the road towards Antioch and the East led, and direct attack promised no success. Barbarossa eluded the Turks by a bold and (as it might appear) impossible march. There is a pass, high and difficult, which crosses to the north where Eagle Mountain merges in Olympus. This pass was undefended, as the Turks evidently considered that it was impracticable for an army; and they themselves were mainly horsemen. I crossed the pass in 1883 on horseback, and know that, though difficult, it is practicable for unencumbered troops. Barbarossa proved this by traversing it with his army (which carried, as we may be sure, the minimum of baggage). No narrative describes how he executed this daring manœuvre in the face of the Turks, but he was aided by their belief that, as the operation was impossible, it need not be guarded against. A night march and a rearguard of cavalry probably covered the crossing, which placed his troops on the opposite side of the mountains from the Turkish forces. An open, easy path leads round the end of Sultan-Dagh (Olympus) through the level Paroreios; and the Turks had to make a long march to Konia, in order to protect their capital against the rapid advance of the Crusaders through that open ground east of Olympus. The decisive battle took place in front of Konia. In the hall of the old Kaiserhaus at Goslar Wislicenus has a fancy picture of this victory: the exploit deserved a better fate and a truer record in art.

III. The allusion of a soldier in the third Crusade, who remembered the mournful sight in the Channel near its eastern end, reveals it as the scene of the greatest disaster that ever befell the Byzantine armies, an event that determined the fate of Asia and Europe and the course of history.† The verbose description of the campaign by Nicetas, a con-

* Antioch was founded to control this road, a little east of the direct path, on a strong site, *c.* 280 B.C.

† The breakdown of a waggon, which impeded the march and caused the catastrophe, occurred just before the road reaches the cemetery of the modern village Gondane.

temporary Greek official and historian, leaves the situation uncertain. He used the excellent narrative of men who fought in the battle; yet from ignorance of the localities and a lack of intellectual grasp he could not make his account clear, or convey a proper conception of the geographical surroundings of events. When, however, the actual scene is determined by the crusading pilgrim, you can recognize every feature that Nicetas mentions and localize every incident of the battle. Nicetas had conversed with men that fought in the battle, and he is stirred into life by the stories that they told.

That terrible battle, or rather massacre, in the Tchyvritzi Kleisoura, in which the Byzantine military power was almost annihilated, and the Seljuk Turks were secured in the possession of Asia Minor, had from 1880 engaged my speculation, and in the *American Journal of Archæology*, vol. i. p. 123 f., I printed a topographical hypothesis of the battle, based on Byzantine records only, and far from the truth. In the map appended to my 'Cities and Bishoprics of Phrygia,' Pt. II., the scene is rightly placed. Opportunity has at last occurred to describe this situation, nearly thirty years after the map was drawn.

In 1176 the Emperor Manuel Comnenus led an army containing the flower of the chivalry of Europe and the best troops of the Byzantine Empire, Norman knights and nobles, and Varangian Guards, a splendid force collected during thirty-seven years of a warlike reign. In 1142 immediately after his accession he had himself led a much inferior army across Asia Minor from Cilicia to Constantinople, passing within sight of the Turkish capital, and so down to the western and northern seas; and now at the culmination of his career, full of confidence in his own courage and in the splendour of his great army, he marched with a headstrong rashness which disdained all precaution, scorning the thought that the light-armed Turkish troops could in any circumstances stand against his approach. Advancing eastward from the lake towards the entrance of the Channel, Manuel passed an old ruined fortification called Myriokephalon, "the place of 10,000 heads"; and Nicetas says that he does not know whether this name was given in memory of the disaster when a myriad Christian soldiers perished in the Channel, or on the other hand the name was really ancient and happened to suit the course of fate.

As the generals in the army of Manuel looked up the Channel they saw the Turkish forces arranged on those bare sloping foothills, threatening the left of the advancing army. It was an elementary precaution of war to clear away the enemy on the flank, before the army advanced up the Channel; but the generals' urgent advice was rejected by the Emperor, who was bent upon showing his contempt for his opponent by marching straight on without regarding the light-armed Turks. The result was what might be expected when an army in such a position was directed by a despot whose native boldness had been exaggerated into empty conceit by thirty-seven years of autocracy. His army was bur-

dened by a siege train, with which he intended to capture the Turkish capital at Konia. In the Channel one of the waggons of the long line broke down and stopped the rest; the van passed on over a rising ground * out of sight; the soldiers and waggons pressed up from behind; the main body became jammed in a dense mass where no one could wield a weapon; and the Turks charging down the slope massacred that great army with the minimum of resistance. Manuel himself escaped almost by a miracle from the slaughter with more than thirty arrows sticking in his shield. At one time he had actually proposed to slip away and leave the army to its fate: to such a point had the deterioration of a naturally brave man proceeded in a long reign, when he was accustomed to think that he was the State and that his single person was the palladium of the Empire. Deterred from this pusillanimous course by the horror of his companions, he struggled on and joined the van, which had learned too late about the disaster, and was now also beset by the Turks. I do not linger on the operations, mentioning only that one can count the "Seven Furrows," where were fought the last episodes of the battle, and in imagination recreate the tree under whose shade Manuel, sitting down to rest or to die, listened to the bitter taunt of a soldier who brought him water. The tree has not survived the lapse of centuries; nor has a new tree grown in its place, because the goats, the enemy of the Earth and her fruits, prevent young trees from growing.

IV. Now we go back 1500 years, not shrinking from the intellectual effort which is required to skip across the centuries. In 319 B.C. Antigonus, a claimant to the power of Alexander the Great, was marching from Cappadocia to crush his opponents, the friends of Perdikkas, in the western part of the plateau. He followed the route along which Barbarossa and Manuel marched in the opposite direction; and, when he came to the "Pisidian Channel," he found his opponents encamped in the passage, intending to bar the way. The rapidity of his march had enabled him to effect a surprise, but he was betrayed at the last moment by the trumpeting of his elephants. His opponents thus learned that Antigonus was upon them, because no other Greek general at that time was using elephants; and Alketas led hastily their light troops to seize the hills on the north side of the Channel (where the Turks afterwards waited to block or harass the approach of Manuel). This was the only possible strategy in the circumstances; and was doubtless the plan by which the associated generals intended to hold the Channel. Antigonus could not disregard the light-armed troops; but he held back his right wing to face them,† while he advanced his left wing and attacked the main body of the enemy, who were buckling on their defensive armour

* This rising ground is crossed immediately after we pass the cemetery of Gondane, a village on the foothills half a mile to our left. The great slaughter took place on the western side of the cemetery. Everything is clear, when we read Nicetas on the spot.

† This is the meaning of Polyænus's phrase (iv. 6, 7), λοξώσας τὴν στρατιάν, with front in echelon.

and had not taken their weapons in their hands. These operations show that there was in the Channel room for an army to encamp and for another large army to advance with a right and a left wing; and yet, while the passage was so broad and open, advance was difficult in the face of a skilful enemy.

The generalship on both sides was excellent, except that the allied generals had allowed themselves to be surprised, being under the impression that Antigonus was still in Cappadocia, or at least far distant. His wonderful march, 2500 stadia, near 300 miles, in seven days and seven nights had escaped their calculations as a possibility. The object of Alketas obviously was to delay the approach of Antigonus by threatening the enemy's wing, while Antigonus's plan of battle was to keep the advantage of surprise. In another place Diodorus reminds his readers that these generals were the men that had fought along with Alexander the Great, and learned in that school of war and adventure. Almost the entire force surrendered, and the opposing army was incorporated in the army of Antigonus. In those wars between rival claimants to power, the soldiers had little preference for one leader rather than another.

The description as it can be gathered either from Polyænus alone or from a comparison of Polyænus and Diodorus suits perfectly in every respect with the situation and character of the Aulôn—an open wide pass well suited for an army to encamp; a road leading from east to west by which a general marching from Cappadocia would advance to attack forces which almost certainly had been wintering in the western part of Asia Minor:* a country on the north side hilly and undulating though not mountainous, and therefore as suited to the cavalry of Antigonus as it proved afterwards advantageous for the Turkish cavalry in the battle of the Kleisoura A.D. 1176. Since nothing is said with regard to any attempt to impede the marching armies on the south, it is obvious that the ground there was not suitable. Still less is there any attempt to meet the attacking army in front: the one advantage for defence lay in attacking the marching enemy on his northern flank.† Yet this advantage was great, as is evident fron the fact that the Aulôn became a kleisoura or frontier line of defence, in the late Byzantine time. This whole description suits the Channel perfectly, and it would be difficult to find any other place which fulfils all these various conditions.

There can be no doubt where the Byzantine battles occurred: the description of the marches of Barbarossa before and after is detailed and clear, and we can trace his course day by day and almost hour by hour. As to the battle of 319 B.C., however, there has reigned a complete mis-

* The position of Alketas and Attalus before they advanced (*πορευομένους*) against Antigonus is unknown; but it is certain they were not wintering in Pamphylia (which is never mentioned in the operations of that time). Rather Lydia or Caria is probable, or even Pisidia (where Alketas was cultivating friendships).

† *ὑπερδέξιος*: this word, indeed, may mean simply "higher," but in the description of a battle it is naturally taken in the stricter sense, Xen. 'Anab.,' iv. 8, 2.

apprehension. All modern historians place the fight on or at the top of the Klimax, the Ladder, the remarkable path by which the road from the low Pamphylian plain ascends to the Pisidian mountain land south of Cretopolis (near Payam Agatch), far away on a road leading north and south. The localities here are in every way discrepant with the ancient accounts given by Diodorus and Polyænus, who in their turn depend entirely on the excellent authority of Hieronymus, a soldier engaged in those wars, knowing the ground in most cases personally, a friend of Eumenes, one of the claimants to the broken empire of Alexander—in short, one of the best military writers in all history.

In the *Journal of Hellenic Studies* I propose to discuss the ancient authorities in more minute fashion than is appropriate to the *Geographical Journal*. Here I mention only that a conclusive argument against the accepted view is the length of the wonderful march performed by Antigonus, which culminated in the battle and his victory. From Cappadocia he marched in seven days and seven nights, a distance of 2500 stadia (over 280 miles), to fall like a thunderbolt on Alketas and his associated generals. This suits well with the Pisidian Aulôn at Gondane measured along the southern route. It is wholly inconsistent with the Klimax. The distance from the scene of Antigonus's operations in Cappadocia to the Klimax by any possible route for an army with elephants is very much greater. Doubtless the length of the march was paced by a bêmatistês, and has been preserved by Hieronymus and Diodorus. I do not know what war elephants can do; * but for a large army containing 40,000 infantry (not to mention 8000 cavalry) to march 280 miles in seven days is a wonderful achievement, and nothing better can be credited. The Klimax is therefore out of the question as the scene of the battle. I climbed the Ladder in 1882, going from the Pamphylian coast to Apameia-Kelainai; but refrain from describing the localities, merely adding that in every way it is impossible and inconsistent with the operations—the battle and the action that followed.

The erroneous views of the moderns are connected with the most pathetic figure in Anatolian exploration. About eighty years ago a German schoolmaster named Schoenborn was smitten with the noble ambition to travel in Asia Minor. After the penurious old fashion they provided him with extremely scanty means for fulfilling his desire. In Germany they know better now.† Schoenborn was a German of the good old type, zealous, careful, and full of fine ideals. Knowing that the journey would be a hard one, he began to train himself for it by sleeping on the floor and other ascetic practices, ignorant that the right preparation for hardship is to live well and start in the finest physical con-

* Elephants, which move very rapidly in case of need, can get over a long distance in one night; but if they are capable of making such an effort as 40 miles per day for seven days continuously, this distance must be a maximum, so far as I can learn.

† This was written a good many years ago.

dition. He died soon after as a result of the hardships of Turkey. In connection with him I think of some of those quaint Germans whom we used to meet in former time (1885–1902) crossing Turkey alone and penniless, begging their way, knowing no Turkish and evidently unused to travel, wandering for no discoverable reason.

Schoenborn did some careful and excellent geographical work, but he was not an epigraphist, and he had no insight in geographical history. Having seen only a small part of Pisidia, he proceeded to fit historical events to the district that he knew, whether they suited or not; and he has been followed by all subsequent writers. He knew the famous pass called the "Ladder," a steep narrow series of rock steps, rising 2000 feet from the south coast lands into Pisidia. The nature of the "Klimax" suits its name, and the march, the purpose, and the victory of Antigonus cannot be adapted to it except on the method of Procrustes. The "Ladder" is on a road leading south to north; but Antigonus from the east was bent on surprising foes who were advancing from the west to oppose him. By no possibility could his enemies encamp in the "Ladder," if they had ever been there, for travellers ascend the "Ladder" in single file (as we did), or two footmen abreast.

V. The most romantic adventures of an inscription that I know furnish the next piece of evidence. The inscription was found by Sterrett at Apollonia in 1884, and published by him in his 'Epigraphic Journey.' The surface of the stone was worn, and the copy was far from complete; hence the meaning remained hopelessly obscure, except that the document was evidently very important. Both Anderson and I have searched the town repeatedly for this stone, from 1888 to 1912; but in vain. G. Hirschfeld of Koenigsberg published a discussion of it containing some useful suggestions, and A. Wilhelm, the Austrian explorer, added other correct ideas; but the bearing and general sense remained as obscure as ever. At last in 1917 Buckler, Calder, and I joined forces and by mutual suggestion and criticism, justified Sterrett's accuracy in a very difficult text and completed it convincingly, restoring to history a monument of exceptional interest and value. The "regulation of the king" is mentioned; the two German scholars were misled by assuming that the inscription records the confirmation of the king's settlement; but it records the rescinding of the king's regulation. The opening word is lost: it was "The people of Apollonia" inscribed on a higher part of the monument: they (honoured) him that altered the king's settlement which assigned to the (Pisidian) tribesmen of Tymbrias the Aulôn (or Channel) leading down to Misylos, and Snake's Head, and the land of Ouramma, and gave those territories to us, and marked the boundaries, in recognition of his justice and lofty spirit.*

* The name of the person who is honoured must have been placed somewhere on the monument, perhaps high up beside the nominative of the sentence. The omission of the verb "honoured" is common.

To readers of this *Journal* the most remarkable feature in that inscription is the geographical enumeration of frontier regions, which had obviously been a Debated Land between the Grecized Phrygian population of Apollonia and the Pisidians of Tymbrias (the northern town of the Pisidian Taurus on this side). The name Snake's Head at once recalled to my memory the whole situation. In 1886, accompanied by Harold Brown of Harrow and Exeter College (who afterwards perished as one of the thirty-three scouts with Allan Wilson in the Matabele War), I traversed the western side of the double lake called Limnai in old times (Egerdir and Hoiran lakes at present). There is just room for a track between the lofty mountains on the west and the Limnai lakes on the east. No one ever passes that way as it leads from nowhere to nowhere, and the mosquitoes at sunset rose in dense clouds to about 20 feet above the water and settled on us with a voracity stimulated to madness by centuries or ages of abstinence from human blood; but, of course, they had been thereby preserved from malaria germs which they can get only from human victims. The picture of the lake scenery, so beautiful and varied, as we look eastward to lake coast and the long ridge of Mount Olympus with the big peak over 7000 feet at its left end (exactly like the view of "long Olympus" and its magnificent peak over 8000 feet * at the left end, rising out of the Ægean Sea as seen from Salonica)—that picture was as fresh in my mind in 1917 as in 1886. I saw on the left the Channel leading down to Misylos, south of it the long promontory of Snake's Head, stretching apparently down from Olympus and reaching far out into the lake as if it were trying to get across to our western side, and again south of this the land of Ouramma, a level tract of land between the ridge of Snake's Head and the Pisidian mountains in which the only town near was Tymbrias. Memory of that geographical view completed the restoration of our inscription. Geography revealed and illuminated a history extending over something like 1000 years: the first conquest of the land on the north of the Pisidian mountains by a warrior tribe from Europe, coming from the neighbourhood of Salonica and crossing the Dardanelles into Asia, overrunning in their first rush more than they could surely and safely hold: the subsequent reaction of Pisidian tribes, whose raids on the level peaceful hellenized land of southern Phrygia were dreaded for many centuries and made the border regions a battle-field in war and diplomacy. The inscription records the final settlement "The king's" arrangements were reversed by a higher power, and this higher power can only be the Roman rule.† Amyntas, king of Galatia,

* "Long Olympus" (μακρὸς Ὄλυμπος) includes (1) the ridge of the Cambunii stretching east from Pindus, the backbone of the Albanian and Greek peninsula; (2) the great peak of Olympus proper at the eastern end.

† Lucullus in 88–84, Pompey in 65–63, Julius Cæsar, even Antony, may be thought of, but I had to dismiss them as unsuitable. The time is 25–20 B.C., and the occasion is the organization of the Roman province Galatia by Lollius, acting for Augustus, and sketching out the course of Roman policy in this new province.

South Phrygia and Pisidia, 39–25 B.C., favoured the Pisidian claims, partly because Galatian policy was anti-Hellenic, partly because he had little hold on the Pisidian territory (which had been granted to him by Rome), and therefore aimed at conciliating the Pisidian tribes and sacrificing the hellenized Phrygians who were peaceful subjects from whom he had nothing to fear, and whom therefore he need not conciliate. The Roman policy, on the contrary, championed the settled law-abiding Phrygo-Grecian cities against the tribal instincts of Gauls on the north and Pisidians on the south, broke the tribal anti-Roman feeling by hellenizing those peoples, and favoured grecized Apollonia against Pisidian Tymbrias.

VI. The long ridge and promontory of Snake's Head and the land of Ouramma promise much to a long-delayed exploration, for the slight excursions made there indicate that interesting discoveries may be made. The name of Ouramma first dawned on history through a curious inscription which I found at Karagatch in Pisidia east of Tymbrias, in 1882, and which remained inexplicable (though its text was certain) until 1917. Two brothers made certain constructions as an ornament and gift to their Pisidian city Anaboura; and they boast themselves to be "descendants of Manes Ourammoês." In 1917 it became clear that Manes was (the god of) the land of Ouramma, whose situation a few miles north-west from Karagatch was now assured. This sun-god, the Masnes of old Anatolian religion, becoming Mannes and Mânes and Mên in grecized society and cult, had a widely extended theocratic authority in the frontier-lands of Pisidia and Phrygia. From him sprang one of those powerful aristocratic families which made the history of Anatolia in so far as it was left to develop freely and not forced out of its course by foreign despots and conquerors. To those families belonged many of the leading early Christian Fathers and many Byzantine leaders and rebels against the despotism of Constantinople; and in the darkness of pre-Roman times we can dimly discern their influence, and see them in their great mansions, which became the architectural models for great and beautiful early Turkish Khans and Medresses and English Colleges at Oxford and Cambridge.

Standing on a firm geographical basis we can for the first time study with new opportunities the evolution of religion and society, and the course of history in Anatolia, a subject on which we must not linger here. Our interest here is confined to one little glen, the Aulôn, on the borders of Pisidia and Phrygia, and to the long slow process of discovering its situation and relations to the surrounding country and the history that was involved in those relations.

It would be long to tell about the land of Ouramma, whose very name was unknown till 1917. It explains other hitherto obscure points in the history of the country. Manes, the ancestor of that Anabouran family, was the god of the neighbouring Ouramma. The Phrygian

conquerors about 900 B.C. found Manes enthroned in the promontory of Snake's Head. Now the Anatolian belief was that heaven is a model and ensample for earth (so Plato, 'Rep.,' ix. *ad fin.*). The Snake which stretches down from Mount Olympus and extends its head out into the Limnai is the divine Snake into which the god transforms himself. In the Mysteries the devotees learned that the Snake was the father of the Bull, and the Bull of the Snake.

VII. Ptolemy mentions a city of Pisidia named Ouranopolis. This strange name wholly unlike Pisidian is evidently Ouramma, to which a Greek sense and a Greek form were imparted by the change of *m* to *n*. Such interchange is not unknown. The old Anatolian town called Sunavos was changed into the Turkish Simav.

The land of Ouramma was divided from the territory of Pisidian Antioch by a ridge which stretches across the Anthios valley, four hours below Antioch, and through which the Anthios flows in a narrow cañon. Ouramma is a level and apparently fertile region surrounded by hills on three sides and by the lake on the fourth. In it are such villages as Gelendos (certainly an ancient name modified in Turkish) and Avshahr and various others unknown. It has been left as yet unexplored. Arundell, Calder, and myself have been at Gelendos and across part of the southern edge of the tract: Sterrett in 1885 and Sir Charles Wilson in 1878 crossed the southern edge all the way from the Demir-Kapu on the lake to Gelendos. The rest is unknown.

VIII. In 1882 we found in a cemetery at the top of "the Channel" beside the village Gondane an inscription 108 lines in length on a column broken into four parts, one of which was lost. On a cold rainy day I struggled with that difficult text, and published it incomplete in the *Journal of Hellenic Studies*, 1883, p. 23 f. It consists of an exordium stating that a certain group of persons had made various sacred utensils for use in their ritual; after this introduction follows a list of more than a hundred members with their subscriptions: the home of each member is stated. Sterrett recopied the inscription in 1884, and published it in his 'Wolfe Expedition,' No. 366: he completed many of the names of members, but erred in the exordium by misplacing the lines. I recopied it in 1886, and another friend and old pupil Callander (Professor of Greek in Queen's University, Ontario) again copied it in 1905; and we had the advantage of comparing previous copies with the stone. In 1906 a restored text appeared in our 'Studies in the Art and History of the Eastern Roman Provinces,' almost complete (omitting only a very few of the proper names and the title of the principal official), which placed it in a class of imperial documents that have been discovered in increasing numbers in the provinces of Galatia and Asia during the interval since 1882. Documents of this class are always expressed according to the same form. A society, uniting in prayer for the Imperial Salvation, makes dedication of ritual objects for use in the imperial religion. This

imperial religion, the adoration of the Emperor as the incarnate deity (called the " worship of the Beast " in the Revelation of St. John), was the pledge and proof of loyalty to the imperial rule and faithfulness to the unity of the great Empire. On this worship was founded the attempt of the Emperors to unite the Mediterranean world through the power of a common ritual, so that all the civilized world should be held together by a common emotion. Religion stood for the modern spirit of patriotism. No other substitute for patriotism could be imagined or devised, and no patriotism was or is yet possible to unify the world from the centre of Scotland to the far Nile at Assouan and to the Euphrates, and from the Carpathians to Tangier and south of Mount Atlas into the Sahara at Touggourt.

At present the specially interesting feature of that long inscription is one that makes it unique in its class: it states the home of every member, sometimes a Græco-Asiatic city, sometimes a Phrygian glen, but generally a village or a farm-steading on the great imperial estates. The task of placing those villages on the map is still too hard, although something has been done. Space does not permit us to estimate all the topographical identifications; but they crowd with names a land formerly unknown. As in the first section of this paper we came along the north coast of the lake and up the " Channel " with Barbarossa, knowing no place in a desert land, fighting our way against the enemy step by step, so we shall be able in the future to specify and can even now in some degree see the features of a smiling and prosperous old Roman country dotted with villages and farms all the way, Carbokome, Lykiokome, Daokome (Wolf-village), Misylos, Marsia, Koundoia, Ganzaia, etc. The Roman Empire was great because it supported and maintained such prosperity, and kept the country blossoming with towns and villages: it fell when a vicious and burdensome taxation sapped that prosperity and gradually destroyed the class on which the burden was mainly imposed.

Such is the geographical history of a Pisidian or Phrygian glen in the Roman period. Its prosperity is older than Roman, and was rooted in a rational system of government and a religion that imposed the laws of sanitation and agriculture on a simple and obedient people, and in a simple social system where a class of higher education lived among and identified its interests and life with the working peasantry, protecting and ordering kindly a dependent class. Difference of race probably or certainly lies at the basis of the distinction in class and work and brains and education.

Another group of these Tekmoreian inscriptions, all mere fragments, was discovered in 1911 and published in ' J. H. S.,' 1912. From this group the remarkable name of an official was recovered, viz. Protanaklites, he who reclines in the first place at table (an evident sign of parody of the Christian agape); and it was then observed that this name

also occurs in the first and most complete document. In this last group there was also recovered a date by the Consuls of A.D. 237, which confirmed almost exactly the date assigned from the first to the original Tekmoreian list, and afterwards to the group as a whole.* They belong to the period 220–260 A.D., but No. 9 in the 'Studies,' p. 332, is probably earlier than that period, having been engraved before the name "Tekmoreian Guest-friends" was introduced.† These Guest-friends were in reality the *plebs collegii*, the whole body of resident cultivators on the Imperial Estates in this neighbourhood, that body of Estates which is described by Strabo as the property of the god of Antioch, which passed into the possession of the Roman Emperor.

The strange name Tekmoreian is derived from the Anatolian word Tekmor, known only at Antioch. In one of the religious rites of the Mysteries at Antioch, the initiated person enters through a gateway into the presence of the god and showed the Tekmor: this act was called by the non-Greek verb τεκμορεύειν, and constituted a proof that the mystes was loyal to the Emperor and an enemy to Christianity.

There are two quaint features about the Tekmoreian contributions in money. They almost all surpass a round number by one, as *e.g.* 6001, as if there were some object in going beyond the limit of the round number. A person who subscribes 6001 denarii has entered upon his seventh thousand.

Again, the amount of the contributions is quite remarkable To some extent this was due to depreciation of the coinage, but there is no reason to think that the denarius had depreciated to such a degree about the date of this inscription, approximately 250–260 A.D., as it did under Diocletian. The large number of inscriptions and the large size of the individual sums make up a total which is practically incredible. Considering how much pretence and sham there was in the life and inscriptions of the country, one suspects that there may also have been some pretence in their religious actions, and some exaggeration in the statement of their contributions. Was it not the case that such pretence was allowed and even encouraged by the priests, and that contributions were multiplied by ten before they were recorded? The number one was then added to hide the fraud. If this were so it would furnish some explanation of the severity of the punishment meted out to Ananias and Sapphira, who pretended to give the entire price of the property which they had sold to the Church in Jerusalem, although they were keeping back part. They were claiming credit for self-sacrifice and piety, quite after the fashion of the Pagan records (according to our theory), and it was necessary, considering the debased state of public

* Published in Annual Brit. Sch. of Athens, 1912.

† That the term Tekmor was an old sacred word is not to be doubted: it perhaps occurs in one of Chantre's inscriptions at Eyuk. It was one of the old religious pagan ideas and names revived during the struggle against Christianity.

feeling on this subject, to put a stop to the first appearance of such sham in the congregation. No falsity was to be permitted, no credit for pretended sacrifice should be allowed, and the death of the first pretenders marked the severity with which the leaders of the Church regarded an act which among the pagans would have been smiled at with leniency, or even kindly approval.

IX. Now we go back to Athens in the middle of the fifth century B.C. A Phrygian slave was dead drunk, and his friends made a mock epitaph on this hero who "died in the war" of Bacchus. In the style of an ancient epitaph the "dead" warrior tells of his Phrygian origin, his home at Athens, his excellence as "the best woodcutter he had ever seen," and his care, characteristic of the Anatolian, for his home after death in the future world. He bears the name, grecized as Mannes Orumaios, of the god who ruled over Orûma (Ouramma); for slaves often were called by the name of a god or hero of their own land; and he furnishes a proof that the Phrygian influence in the first years of its conquest (perhaps in the ninth century B.C.) penetrated far into the Pisidian land and shows us a picture of the tide of war and the change of possession in those frontier lands. We can in imagination see the first great offensive of the Phrygian conquerors carrying them far to the south, and then the counter-attacks of the Pisidian mountaineers of Taurus, which nibbled away one district after another from the victorious Phrygians, making the tide of possession and victory sweep back and forward in the Debatable Land.

The application of long-discovered but incompletely understood inscriptions to recreate geography and history illustrates the excellent words of Professor A. Emerson, who stated well the nature of epigraphic study, "Inscriptions are discoveries capitalized, as it were, and the income of them is only gradually realized." A scholar, as he reads over a collection of inscriptions, gathers his income according to his knowledge year by year; and the income is never exhausted except by death.

X. One useful line of discovery has been little worked in the preceding remarks, viz. modern survival. In 1882 I was told that there was a cave in the northern front of the long promontory called Snake's Head, and that the Greeks came in numbers every year on August 15 to celebrate a religious ceremonial. This, of course, is the Assumption of the Virgin, Koimêsis tês Panagias; and the Virgin Mother of God has here taken the place of the old Virgin of the Limnai, Artemis or Cybele, Virgin and Mother of the gods. In the Tekmoreian inscriptions, it is the goddess who appears, not the god; but in the literature and the coinage and the monuments of Antioch only the god Mên (Masnes-Mannes-Mânes) is mentioned. Hellenism emphasized and made public the honour of the god, but in the Mysteries the real nature of the complex divine power was revealed to the initiated; and as Anatolian paganism was allied with the Empire in the last struggle against the rising force

of Christianity, it was the goddess, not the god, that again stood forth in the second to the fourth century. Swinburne rightly makes the late Pagan priest speak of "our mother, a blossom of flowering seas, clothed round with the world's desire as with raiment and fair as the foam, and fleeter than kindled fire and a goddess and mother of Rome." This is the spirit of the late reviving worship of Artemis of the Lakes.

This Greek survival of the old worship started me in 1882 on the investigation, the results of which have just been described. Only in 1912 did the opportunity occur for Anderson and myself to visit the cave of the Panagia,* which is a rude chapel halfway out in the promontory, where evidently a hermit made his holy abode and doubtless remained in death. In reading the *Acta Sanctorum* I found his name, St. George of the Limnai, who lived about the end of the sixth century, when the festival of the Koimêsis was recognized by the Emperor Maurice and the Orthodox Church. In the brief note about his life, he is connected with Mount Olympus, and we remember that a village Olympokômê occurs in the Tekmoreian inscriptions. This hermit and his living martyrdom gave a local habitation to the growing popular feeling in favour of the worship of the Virgin of the Lakes. The festival, which was an annual event bringing many Greek devotees far into a purely Turkish country, was dying gradually during my experience, and probably will not survive the calamitous events that followed the European Greeks' foolish and wild attack on Smyrna and the Anatolian plateau in 1919–1922, which has destroyed the immense influence exercised by the Asian Greeks in Asia Minor.

The great natural gateway below the chapel on the water's edge, and the grave of an old Phrygian chief, some leader of the Phrygian inroad into this country, close to the chapel, show how the nature of the original Anatolian worship survived all changes of race and external religion. The natural gateway is the door by which the worshippers entered the presence of the goddess of the Limnai.

The following figures may be useful:

Heights above sea-level: Limnai, 922 metres (3025 feet); Caralis, 1120 metres (3672 feet); Trogitis, 1094 metres (3598 feet); end of irrigation canal near Tchumra in Konia plain, 1020 metres (3340 feet). Length of irrigation canal (including parts of Irmak and of Tcharsharuba river) from Caralis to Tchumra, 200 kilometres.

* Miss Gertrude Bell, at my request, visited the place in 1907, and described it in a letter to me at the time.

REVIEWS

ASIA

Travels in Eastern Tibet.— Eric Teichman, C.I.E. Cambridge: University Press. 1922. *Map and Illustrations.* 25*s. net.*

THROUGH Eastern Tibet, or Kam, on the borders of the Chinese provinces of Szechuen and Yunnan and of the Kokonor country, lies the trade route from southern China to Tibet. At its door in the last sixty years many travellers have knocked. Some, like Cooper and Gill, have been turned away. Others more fortunate, such as Welby, Bower, Kozloff, Rockhill, and Tafel, have traversed it in haste and unwelcome, while De Rhins and Rijnhart have been murdered. To other difficulties have been added those of nature in the high mountain ranges which separate the great rivers Yalung, Yangtse, Mekong, and Salween, forming cañons thousands of feet deep.

Mr. Teichman had the good fortune to escape all other difficulties than those of nature. The fortunes of Tibet and China, of which a clear and concise history is given in the earlier chapters, had in 1918 conspired to require a mediator who would stay the advance of Tibet on Szechuen before territory had been seized which would provoke a permanent feud between the two countries, and Mr. Teichman, the British Consular Agent in western China, was detailed for the duty.

Starting from Tachienlu he found it necessary to make an immense détour in order to reach Chamdo, where the Tibetan commander-in-chief had his camp, without passing through the lines of the opposing armies. Following the main road to Lhasa by the line of the Yalung valley viâ Kanza as far as Nando, he then struck north into the Golok country and thence descended by a westerly route to Jyékundo on the Yangtse. There he came into the Tibetan lines and struck ground already traversed by Rockhill, Kozloff, Tafel, Bower, and others. But leaving the main road to Chamdo he turned west to Nagchen, apparently to trace the headwaters of the Mekong formed by the Dze Chu, the northern and eastern branch, and the Ngom Chu, composed of the waters of the Bar and Dje Chu, the two main streams uniting at Chamdo.

The journey to Chamdo had taken from March 1 to May 20, and on the latter part of the journey traces of the devastation due to Chinese armies were evident on all sides in villages ruined, farms burnt, and monasteries—and especially the magnificent monastery of Chamdo—absolutely destroyed.

At Chamdo the Tibetan troops under the Kalon Lama, the Tibetan commander-in-chief, were well organized and equipped, and he was practically assured of success if he advanced against the Szechuen forces, which received no support from the Mohammedans in the west nor the Yunnanese in the south, and little support from the Peking Government. But he readily entertained a proposal to stay his advance if the Szechuen authorities agreed to make peace, and he also allowed Chinese non-combatant prisoners to accompany Mr. Teichman to Batang, to which place he wished to carry this news.

On the road to Batang viâ Draya Jyambun, Markam Gartok, and Bum La many other refugees were picked up. Some of these went south to Yunnan. The others on arrival at Batang were mostly plundered by the Chinese soldiers.

As communications with the government of Szechuen were interrupted and its consent could not be obtained for some time, Mr. Teichman returned to Chamdo taking the Chinese general with him. On this occasion he travelled by a more direct route, ascending the valley of the Ong Chu, a tributary of the Yangtse, towards Draya Jyambun and thence onwards to Ipi La by a road to the north of his previous route.

At Chamdo the Kalon Lama had given orders for a cessation of hostilities pending receipt of news from Szechuen. But in the north-east the tension between Tibetan and Chinese forces in trenches only a few yards apart was such that Mr. Teichman started off for Rongbatse (near Kanza) to preserve peace if possible, visiting on the way Dege Gönchen, the famous monastery where Lamaist scriptures are printed.

After some tedious weeks of waiting for Szechuen's acceptance of the Kalon Lama's proposal, Mr. Teichman again returned to Chamdo to arrange the release of Chinese prisoners. Taking a new route across the Yangtse–Yalung divide, three passes of about 16,000 feet were traversed in quick succession. The Yangtse was crossed below Beyü. From Nadzong La (16,000 feet) he looked down on the Re- and Mar-Chu, which afterwards unite and flow to the Yangtse. Thence travelling to Gonjo Dzong and Draya Jyambun he made his way by the Me Chu valley to Chamdo.

A dispute between Tibetans and Chinese at Yenching carried the peacemaker off again, and taking a final leave of the Kalon Lama (of whom he writes, "I have learned by experience that a high Tibetan official never fails to carry out his promise") he travelled south, crossing the Riwoche river and following the Yu-chu valley to Di, above the point where the river makes its remarkable bend to join the Salween near Menkung. Two more days brought him to Yenching, and after settling the dispute he left for Batang.

At Batang the crowd of Chinese refugees which clung to him in each journey east was swollen larger than ever. But in the territory administered by China brigands also swarmed, and attacks on his party forced Mr. Teichman again into Tibetan country, where, travelling viâ Beyü to Kanze, he reached the main China–Tibet road and arrived safely at Tachienlu after eleven months' absence. In that time he had traversed Kam from north to south, had crossed and recrossed its rivers and ranges at different points, and had had a welcome in towns from which earlier travellers had been jealously excluded. With the exception of the main road from Jyékundo to Chamdo and Batang, the country was in the main new. Kozloff had travelled from Chamdo to Chunkor Gomba on the Yangtse, lat. 32° 29′, and had seen parts of Nagchen unvisited by Teichman. And Tafel had followed a route from Jyékundo to the Yalung, where his company was stoned in crossing the river. But with those exceptions and Mr. Coales's recent discoveries on the Yangtse, our knowledge of Kam would seem to be almost confined to the routes traversed by the author.

His knowledge of Chinese and Tibetan and the nature of his mission combined to place opportunities in his hands such as no other foreigner had enjoyed, and the book is full of notes on the government and relations of the different parts of eastern Tibet. While it throws into strong relief the ability of Tibetan leaders and the advance made by the country in military organization, it gives a pitiful picture of the condition into which western China has fallen under a republic.

Mr. Teichman appears never to have been acclimatized to high altitudes, though he seldom descended to 8000 feet, and it is curious that the Chinese refugees who encumbered his march were apparently able to cross ranges of 14,000–15,000 feet on foot without serious suffering.

Though little space is given to any account of the fauna, the tameness and abundance of animals in grasslands neighbouring the temples is referred to frequently. It must indeed be a strong religious scruple which secures sanctity to animal-life in a country where the main food consists of *tsamba*, *i.e.* barley, stale milk, and tea leaves, rubbed into a paste and occasionally supplemented with strips of dried turnips.

It is difficult to decide whether the political or the geographical element in the book is the more interesting. Perhaps it may suffice to say that those who have read Mr. Rockhill's books will welcome this volume as another in the same style and worthy to be classed with them. It has but one defect: the publishers have used the worst of papers for the route map.

W. R. C.

AFRICA

A Grammatical Guide . . . in the Ewe Dialect.— Prof. D. Westermann, translated by **C. D. Trotter.** London: Crown Agents for the Colonies. [1921.]

The name of the author of this little work, published apparently by the Gold Coast Government, is a sufficient guarantee of its value; it is made up of three pages on phonetics, sixteen on grammar, and sixty-three of vocabularies and texts. The key to the pronunciation is in part taken direct from the German, and, quite unnecessarily, a German illustration of the sound of *ng* is given; *dz* is said to be *d* followed by a soft *s*, but what is meant is an English *z*. The remarks on musical intonation, here called "inflexion," would have been far more intelligible with illustrations in musical notes. For the beginner it would have been a great boon to have word for word translations of the Ewe; "the scholars are noisy" appears however as "there is commotion among the scholars," and in the absence of an interpreter the meanings of the individual words is not to be guessed.

The Ewe dialect, or rather language, is of more than local interest, for it is nearly akin to the tongue of Benin; it is the Negro language of which we know more than of any other, within or without British dominions, and Westermann's larger works on it are models of exact learning. N. W. T.

Bantu Beliefs and Magic.— C. W. Hobley. London: H. F. & G. Witherby. 1922. 18*s. net.*

This book, containing a detailed account of the beliefs and ceremonies which characterize the religion and life of the Kikuyu and Kamba tribes of Kenya colony, is divided into three parts. The first deals with Natural Religion, in which the surprising prevalence of *tabu* will strike the reader. The longest chapter in the book devoted to "The Curse and its Manifestations" is extraordinarily interesting, and will be a revelation, even to the ethnologist. The second part, on Magic, contains much information regarding the smiths and magicians of these tribes. The third treats of tribal matters generally, as the councils, oaths, war and peace, legends, and dances, and includes an illuminating chapter on "Woman as a Factor in Tribal Organization."

In a penultimate chapter the author in a few wise and pregnant pages shows the practical application of his researches. It would be well if they could be read and digested by all legislators, officials, and missionaries, indeed by every thoughtful citizen of the Empire. Space will not permit even the briefest summary, but their gist may be gathered from the following passage: "The writer's main object has been to demonstrate the fact that the tribes under review possess a system of natural religion more elaborate than was hitherto suspected, and he must frankly admit that although living for some years in close touch with these natives, he had no idea of the extent and variety of the ceremonial connected with the tabu beliefs, sacrifices, and other cognate branches of their beliefs. The light which the inquiry has thrown on the complex nature of a native's life is somewhat of a revelation. It should serve as a warning to rash reformers who consider that so-called pagan heathendom

can be abolished by a stroke of the pen. This attitude should most certainly be avoided in Africa as much as in India. The beliefs of an African are as real to him as those of a Buddhist, although they may belong to a different and more primitive plane of thought. . . . Progressive Europeans are at times apt to sneer at native beliefs, and to feel very impatient with them: there is no doubt that these beliefs tend to check progress and development as we understand them. Although this cannot be denied, we must not lose sight of the fact that on the whole they undoubtedly act as a moral restraint, and perform very much the function which a dogmatic religion fulfils among people of a higher culture."

The author has undoubtedly justified his contention that the study of such questions is not merely academic, but is of the greatest practical value to the administrator, the missionary, and the colonist, as well as to the student.

The concluding chapter on "East Africa after the War" considers the native in relation to the Government, to the proselytizing of Christianity and Islam, to education, and to labour. Coming from an official with the long experience, and with the sympathetic yet critical mind of Mr. Hobley, it is undoubtedly a pronouncement of great value, and it is to be hoped that it may be read and pondered by governor and governed.

It is to be feared that the very detailed accounts of much that Mr. Hobley describes may sometimes appear tedious to the reader, and make him unappreciative of their significance. The author would have been wise, we venture to think, if he had extended his introductory remarks so as to include a good deal of his concluding matter. He could then not have failed to engage the interest of his readers at the outset. E. A. P.

AMERICA

The Edge of the Jungle.— William Beebe. London: H. F. & G. Witherby. 1922. *Illustrations.* 12*s.* 6*d. net.*

The author of the 'Edge of the Jungle' is already well known to English readers through his 'Jungle Peace.' Mr. Beebe is curator of birds for the New York Zoological Society, but of recent years he has devoted most of his time to the biological station which that Society has established in British Guiana, and of which he is director. His most important work is the 'Monograph of the Pheasants,' which embodies the results of much patient observation of the birds in China and other parts of Asia. The present volume, though it has no geographical interest, will delight all travellers who are naturalists (are not travellers nearly always naturalists?), and more particularly those whose ways have led them into the forests of the tropics. They will be thrilled by the descriptions of the common sights and sounds of the forest, which they have often themselves in vain tried to put on paper: the stillness before the rain, the hush of the noontide heat, the sudden crash of a giant tree by night, and the whisper and stirring before dawn. Mr. Beebe does not travel far from his bungalow; many of his observations are made sitting on his verandah or lying in a hammock, in the cleared compound, or on the river-bank close by. The edge of the jungle is in fact the limit of his wanderings. Several chapters are concerned wholly with ants. There are ants which can travel long distances carrying heavy burdens at a speed equivalent to a mile in two hours and fifty-six seconds. There are small ants whose duty is to clean and massage the warriors and weight-carriers, when they return travel-stained to the nest. "The small ants scrubbed and scraped him with their jaws, licking him and removing every particle of dirt. One even crawled under him and worked

away at his upper leg-joints, for all the world as a mechanic will creep under a car. Finally, I was delighted to see him do what no car ever does, turn completely over and lie quietly on his back with his legs in the air, while his diminutive helpers overran him and gradually got him into shape for future battles and foraging expeditions." There are ants which cultivate gardens of fungi to serve as food for the workers in the nest. Others again have jaws of so great size and strength as to be employed in native surgery. "This mechanical vice-like grip, wholly independent of life or death, is utilized by the Guiana Indians. In place of stitching up extensive wounds a number of these giant Atta Maxims are collected, and their jaws applied to the edges of the skin, which are drawn together. The ants take hold, their bodies are snipped off, and the row of jaws remains until the wound is healed."

But the book does not treat of ants alone; there are birds and frogs, raccoons and vampire bats, manatees and singing cat-fish; all these and many besides Mr. Beebe has observed at closest quarters, and he writes of them in delightful language with a whimsical humour. In one case only does common experience differ from that of Mr. Beebe, who writes: "Usually, both in tropics and in tempered climes, one may boldly lie with face uncovered to the night." Either British Guiana is singularly free from mosquitoes, or Mr. Beebe is one of the fortunate few whom those pests dislike.

There have been notable cases in recent years of books about natural history written in graceful language and a scholarly style, whose authors have gained reputations as naturalists far greater than they deserve. Mr. Beebe's books are at least comparable with those in manner, and his deep and scientific knowledge of the creatures he describes is beyond all question.

A. F. R. W.

POLITICAL AND ECONOMIC GEOGRAPHY

Inheriting the Earth.— O. D. von Engeln. New York: Macmillan Co. 1922. Pp. 379. *Price* 9*s*.

This is a disappointing and—to one who has been much interested in Prof. von Engeln's work—a rather exasperating book. It promises so much, and so often just fails to accomplish. The reason perhaps is that the author is a professor of physical geography, and is really writing in a "foreign language" when he enters the sphere of applied geography. To the non-geographical reader, no doubt, the book may be of real value, for it will give a good idea of the extent to which economics to-day has to turn to geography for principles, and some idea of our past, present, and probable future supplies of the necessaries of life and the extent to which the Earth can apparently furnish these supplies. But even the casual reader will notice at once that the book is really two books—one dealing with political and the other with economic geography, and that neither is really satisfying. Indeed, one admirable feature of the work, the scrupulous care and accuracy with which the author summarizes the opinions of, and gives actual passages from, other authors, helps to give an impression of patchwork, if not actually of scissors and paste.

What we may call Book I. deals with such subjects as the similarity and dissimilarity of nations, the relation of the land to its people or the people to their land, the relation of the individual to the nation and of one nation to another nation, the composition of environment, etc. And, though this part of the work is distinctly better than the economic part—which, though careful and comprehensive, is neither new nor very stimulating, especially in its "Conquest of the Tropics"—there is a good deal that is open to question both geographically and politically or historically.

The most interesting pages are those devoted to an analysis of the various meanings attached to such words as "Nation," "State," "Country." The attitude throughout is that of a protagonist of the White "race"—by which is meant the various wavy-haired peoples; and there is an implicit assumption that "White" organization is the best of all, and more or less justifies the appropriation of inferior peoples' lands for such organization. This, of course, almost means that temperate lands have a right to exploit tropical lands.

The author's special interest in physical geography naturally colours his whole attitude to the phenomena of political geography, and he does good service by insisting on terms being used precisely. Thus (p. 33) he limits the use of the term "Nation" to express "the double concept of an organized people occupying a given place"; "State" indicating distinctively "only the organization"; and "Country" being reserved for "the location and area of the place occupied and controlled by the people." Obviously, then, where a State and a Nation naturally coincide, the State is the creation of the Nation; in Switzerland, for instance (p. 5), "the state exists primarily as an expression of determined likemindedness."

He distinguishes carefully between the basis and the tests of nationality. The former is "environment, the adjustment of the people to the land, the geographical equivalent of consanguinity" (p. 9); "it is the place that makes a people what they are, and develops that consciousness of likemindedness on which any self-determination must ultimately rest" (p. 33). "The production of nationality is simply the physical and mental adaptation of the individual of each generation to the place in which he lives" (p. 43); "nationality is the habits, mental and physical, that the place engenders in the individual." It is true that "the occupants of the possible extremes (in the whole area) may be subjected to quite different influences"; but this is of little importance, because they are "linked together by the intervening groups."

Nationality, then, is simply regional consciousness, tand must be weak where the link between people and place is weak, *e.g.* amongst primitive hunting and fishing nomads, and strong where the link is strong, *e.g.* where commercial and industrial activities imply a wide possession and a close utilization of the resources of the land. It may be strong also where continuous isolation has crystallized environment, as in the ghetto (p. 49). In any case, nationality, or regional consciousness, is a necessary and most valuable element in progress; patriotism is only allegiance to the region and its peoples; and "self-determination" promises to coordinate people, place, and state. But, "if patriotism does originate in place, it may be fostered and intensified without fear of initiating a series of sinister developments" (p. 89); indeed, world concord will be greatly helped by promulgating widely the truth that patriotism—as distinct from racialism—simply expresses enthusiasm for the idea of every region being conscious of itself,—what it can do, and give, and needs to get. Conflict arises only out of false conceptions of the basis of nationality.

As to the tests of nationality, they are, "in something of their order of importance, race, language, religion, system of government" (p. 8); and the author asserts that "the most firmly established division . . . based on *race* is determined by the *colour of the skin*"! This is the first of a number of disputable statements. Another is that wide area (p. 65) is essential to afford the proper measure of opportunity, necessity, protection, to bring about the first germ of national organization. Surely just the contrary is true; the smaller the adequate minimum, the sooner do the people feel conscious of that unity of experience and that intimacy of intercourse which are the real factors at

work. Indeed, we are told (p. 79) that one result of the extension of the Roman Empire was that "the Romans lost their own sense of place, and hence of national unity." A third very doubtful statement is that "place is competent to modify greatly the mental outlook, habits, and perhaps even the physical constitution of peoples *in a surprisingly short time*" (p. 83). What does "short" mean? Few of us would accept Prof. Boas' interpretation. Other very disputable opinions are—that the Romans *enslaved* cultured people whom they conquered (p. 93), and that they *invented* roads (p. 219); that Indian wells are deep (p. 281); that the words "steppe" and "prairie" may be used of the llanos and campos of the South American tropics (p. 280); that acclimatization is the same as climatic naturalization (p. 308).

The book is, however, an important one. No difficulty is consciously shirked; every aspect or topic is touched on; it teems with suggestions to examiners and examinees of all possible human questions; it is transparently honest and careful; it is modern and not too optimistic. For instance, there is due warning (p. 155) that the rosy future of nationality and national life is threatened by one great danger—"the overbreeding of the unfit"; and that, "tho' the place is fundamental, it does not follow that an identical culture would result from placing unlike peoples in the same region" (p. 62), or "that the national organizations and institutions developed in the northern temperate lands will serve as the basis on which the tropics may also be made to yield their fullest resources for the benefit of mankind as a united and cooperative whole" (p. 307). L. W. L.

GENERAL

The Expansion of Britain from the Age of the Discoveries: A Geographical History.— W. R. Kermack, M.C.

The World about us: A Study in Geographical Environment.— O. J. R. Howarth, O.B.E., M.A.

The Peoples of Europe.— H. J. Fleure, D.Sc. London: Oxford University Press (Humphrey Milford). 1922. *Price 2s. 6d. each.*

These three small volumes are all of similar size and format, and apparently, though no direct announcement is made, are the first of a new series. Each contains approximately one hundred pages, is illustrated by sketch-maps, and deals with problems either wholly or partially geographical. All are marked by freshness and originality of treatment, and the series, if continued along the same lines, should constitute a notable contribution to geographical literature.

So far as subject-matter is concerned, Mr. Kermack's book may be said to have the advantage in that the author deals with a definite and sharply circumscribed topic, capable of being treated with a measure at least of completeness within the limits of the space allotted. He defines his aim as being to look, from a geographical point of view, at the history of the settlement and growth of the great Dominions of the British Commonwealth, and the foundation and expansion of the Indian Empire. The book is illustrated by some admirably clear, and strictly relevant, sketch-maps, and the relation of historical events to the geographical background is well brought out. The book should find readers among school teachers, who will find much that is of use to them, among geography students, and is written in such an interesting fashion that it will be read with pleasure by the general educated public.

Mr. Howarth and Prof. Fleure, on the other hand, seem to us somewhat handicapped by having subjects so wide that full treatment is hardly possible. Severe compression necessarily results, and it appears doubtful whether the

trend of the authors' thoughts will always be quite clear save to the instructed reader. In Mr. Howarth's book, also, the generalizations seem at times too wide. He begins by pointing out that the brief space available makes it necessary for him to make general statements and then examine them, "using caution," instead of adopting the logically better method of proceeding from the particular to the general. His method leads him to adopt what M. Lucien Febvre (cf. this *Journal*, vol. lx. p. 308) calls "geographical determinism," sometimes formulated with some crudeness. For example, we are told that "climate . . . dictates to man what crops (if any) he may, and what he may not, cultivate." If there is a considerable element of truth in the statement, it seems to make little allowance for human ingenuity, whether manifested in modifying the incidence of the climatic factors, as by protection or irrigation, or in producing special varieties of plants adapted to quite different climatic zones from those occupied by the original wild species, or the forms first cultivated.

Prof. Fleure's book deals shortly with the chief "races" of Europe, and then with the existing peoples, their languages, their distribution, and their interrelations. It is thus largely a study of post-war Europe, and of the causes which have produced existing conditions. It may be said to be primarily a book for the general reader, rather than for the geographer as such, and should prove of much value in helping to make clear the importance of the geographical background in connection alike with political and economic problems.

M. I. N.

Die Entstehung der Kontinente und Ozeane.— Von Dr. Alfred Wegener. Dritte gänzlich umgearbeitete Auflage. (*Die Wissenchaft*, Bd. 66.) Brunswick: F. Vieweg & Sohn. 1922.

In view of the recent discussion at an Afternoon Meeting of the Society on Wegener's hypothesis,* it is unnecessary to give a detailed notice of the book here. It is sufficient to say that it is eminently readable and commendably brief. The elaborate structure that the author has built up rests on no very secure foundation and affords many opportunities for criticism, but he has done good service in directing attention to the importance of studying the movement of the continents relatively to one another, a movement which undoubtedly occurs though we are not at present in a position to form a definite idea as to its extent. It may be so extremely slow as to be inappreciable, except after long periods of time.

The author lays stress on the increase of the difference in longitude between Greenland and Europe, as determined by lunars in 1823, 1870 and 1907, amounting altogether to 1190 metres, which he contends exceeds the limits of error. The apparent increase of the longitude of Cambridge, Massachusetts, between 1872 and 1914, which rests on first-class astronomical observations, is much smaller, only 0·023 second of time, or 7·4 metres. This is distinctly within the limits of error. In the case of the great observatories, the routine observations in connection with wireless signals will before many years are past put us in a position to decide whether any really measurable changes of longitude are in progress, but some organization to obtain trustworthy results from outlying localities seems to be required.

J. W. E.

* See *Journal*, March number, pp. 179 *et seq.*

THE MONTHLY RECORD

EUROPE

Norden's Map of Hampshire, circ. 1595.

THE Society has lately secured for its collections a copy of the re-issue, by Peter Stent in the seventeenth century, of John Norden's map of "Hamshire," of the first issue of which no copy seems to be known, although the original MS. map, in colour, by Norden's own hand, has since 1881 been in the British Museum. Even the later issues of the map, by Stent and his successor Overton respectively, are practically ignored by those who have touched upon Norden's cartographical labours, possibly because they have thought such issues to be merely reduced versions of the map, such as had already appeared in 1607 in Camden's 'Britannia.' An inspection of Stent's issue now in question, and its comparison with the MS. map in the British Museum, show (1) that it is a close copy of the latter, with which it exactly agrees in scale; (2) that it is printed from an earlier plate on which certain additions, *e.g.* in the explanation of the symbols employed, have been rather clumsily made. The British Museum possesses no copy of Stent's re-issue, but has one of the later issue by Overton, whose name appears in place of Stent's, which has been imperfectly erased. This issue by Overton was mentioned by Sir Henry Ellis from second-hand information in his notes on Norden included in the Camden Society's edition of the 'Essex' (1840), but with the erroneous statement that it was of a smaller size than those in Camden or Speed. The question remains when the plate used by Stent was originally engraved. As his name seems to have been inserted by the later hand, we are ignorant who was the original publisher. But as Symonson's map of Kent, 1596, was issued by "P. Stent" (possibly the father of the "Peter Stent" who re-issued the Hampshire, and who was in business as late as 1665) it seems likely that this older Stent also brought out the Hampshire before 1600, especially since the royal arms in the corner are those borne by Queen Elizabeth, without the Scottish and Irish quarterings introduced on the accession of James I. It would be of much interest to discover whether any copy of the original issue still exists. So far back as 1727, according to a statement quoted by Sir H. Ellis, even the later issues were rarely to be seen.

Agriculture and Population in Galloway as influenced by Physical Conditions.

An instructive study of this subject is contributed to the *Scottish Geographical Magazine* (October 1922 and January 1923) by Mr. William A. Gauld, who writes with full knowledge not only of Galloway as it now is, but of its history and economic conditions in the past. By its comparative isolation from the rest of Scotland, both naturally and historically, Galloway forms a suitable subject for such a study, its individuality having always found expression in the general use of the name for this part of south-west Scotland. In the first of the two papers Mr. Gauld examines the natural character both of the region as a whole and of its constituent parts, treating in turn of its surface as moulded by its geological history, its climate, vegetation and soils. A single point only can here be mentioned, namely the influence on the economic life exercised by the recent soils of glacial origin, which often permit cultivation while the low-lying flats are occupied by undrained peat-bog. This is illustrated even by the place-names, *e.g.* the large number of farms beginning with "drum." As a result of the detailed study the whole area is divided into natural units.

In Wigtownshire we have the three divisions of the "Moors" (in the north), the "Machers" or southern, and the "Rhinns" or western, peninsula, the common local use of these terms bearing witness to their natural individuality. In Kirkcudbright the units are less distinctly marked, but may be defined as (in the north-west) the High Moors, the Glenkens valley, and the Low Moors; (in the south-east) the Southern Moors and Coast Belt, and the Central Belt. An analysis of the agricultural statistics is held to justify the subdivision adopted. The larger percentages of grain and root crops in the western county arise from its greater physical uniformity, its lower elevation, and lesser rainfall; within it the "Rhinns" unit is pre-eminent in agriculture. In Kirkcudbright the Low Moors show an improvement in agriculture eastwards away from the rainfall maxima, but the highest percentage of cultivated land is found in the Central Belt, where agriculture takes a more specialized form than in the Coast Belt. In the latter part of the study the writer discusses the different types of farming within the province—dairy farming, stock farming, sheep farming (on the hill and lower moorland pastures), and arable farming—and traces the relation of these to the movement of population during the past 170 years in each of the units adopted. Although the highest level was everywhere reached about 1851, with a general decline since, the different kinds of farming have been somewhat differently affected. The changes have been most marked in the lowlands, while there has been a general stability in the hill lands where the sheep industry has always been the main type of rural economy.

ASIA

General Pereira's Return Journey to China.

In a private letter to a friend in this country, General Pereira reports his arrival at Tengyüeh, on the Burmo-Chinese frontier, on his way back to Peking after his remarkable journey thence through Tibet to India. He proposes to pass through Kweichow, Kwangsi, and Kwangtung to Pakhoi and Hainan Island, whence he hopes to go north to Peking by the coast ports.

The Distribution of Earthquakes in the East Indian Archipelago.

M. de Montessus de Ballore's seismic map of the world is based on a great catalogue of nearly 160,000 earthquakes. Of this number 91 per cent. originated along two narrow bands which occupy great circles of the Earth—the Mediterranean or Alpine–Caucasian–Himalayan circle and the circum-Pacific or Ando–Japanese–Malayan circle. One of the points of intersection of these circles lies in the East Indian archipelago, which is one of the most unstable regions on the globe. Dr. S. W. Visser has recently published two important memoirs ('Koninklijk Magnetisch en Meteorologisch Observatorium te Batavia,' Verhandelingen No. 7, 1921, and No. 9, 1922) on the distribution of the earthquakes in the archipelago, the conclusions of which are here summarized.

During the eleven years 1909–19, 2234 earthquakes were recorded as felt in the East Indian archipelago—230 in western Sumatra, 333 in western Java, 240 in Buru, Ceram, and Banda, 127 in New Guinea, and 33 in Borneo. These figures cannot be regarded as proportional to the actual numbers that occurred in the different islands, for they depend on the density and civilization of the population. It is clear, however, that western Java and the central area of the Moluccas are marked by a high seismic frequency, that the figures are considerable for a country so scantily populated as New Guinea, and that a large district, including eastern Sumatra and all Borneo, except the eastern portion, is almost free from earthquakes.

More exact results are given by the records of seismographs at Batavia, Malabar, Manila, Sydney (Riverview), and Zikawei. With their aid Dr. Visser has determined 160 epicentres off the west coast of Java, and 120 epicentres in other parts of the archipelago, the earthquakes in every case being recorded over a large area of the globe.

As a general rule the epicentres are situated on the steeply sloping sides of deep oceanic troughs, though a few of them occur on land. The map on which they are plotted reveals the presence of four regions in which great earthquakes originate. These are: (1) The Indian Ocean off the coasts of southern Sumatra and western Java; (2) The Celebes Sea and the Pacific Ocean south of Mindanao, continued towards the north in the highly seismic Philippine archipelago; (3) the southern and eastern borders of the Banda Sea; and (4) the mountain ranges of New Guinea. Few epicentres occur on land or at sea far from the coast. In the first region, the earthquakes emanate mainly from the trough between Sumatra and the islands to the west and from the escarpments of the Indian Ocean near the Sunda Strait; few originate more than 400 kilometres from the coast. The great earthquakes of the Sunda Islands are connected with submarine slopes and especially with the trough to the north of the islands of Sumbawa and Flores; those of Celebes with the slopes to the north of the Xulla Islands, and those of the Moluccas with the slopes which border the Banda Sea. The most important seismic region of the archipelago is that which lies to the south of Mindanao.

Comparatively few epicentres lie on land. Several great earthquakes originated on the northern slopes of the high mountain ranges of central New Guinea. In Sumatra during the thirteen years 1909–21, 13 out of 859 earthquakes of various intensities had inland epicentres; in Java 6 out of 748 earthquakes. In Sumatra, the distribution of the epicentres is remarkably regular. For the most part they lie along a great fracture which traverses the Barisan mountain range from end to end of the island and along which occurs a series of longitudinal valleys. In Java the distribution is less simple. Violent earthquakes occur on the slopes of some volcanoes in the west of the island, especially Mount Gede and Mount Tjerimai. The earthquakes are, however, tectonic and not volcanic. Indeed, at the times of severe earthquakes, the activity of the volcanoes is either slight or altogether absent. Mount Gede alone showed some trace of activity during the earthquakes of 1834 and 1900.

In strong contrast with these remarkable earthquake zones are the aseismic districts of the archipelago. A large region, belonging to the Asiatic continent and including eastern Sumatra, northern Java, all Borneo except the eastern coast, with the southern China Sea and the Java Sea, is practically free from earthquakes. The bottom of the Indian Ocean at some distance from land is probably aseismic. The bottom of the Arafura Sea, belonging to the Australian continent, is stable; so also is the bed of the Pacific Ocean.

C. D

AFRICA

A Tense Moment in African Survey.

The exciting moments which sometimes fall to the lot of the keen surveyor while at work in the field are exemplified in the following passage from a private letter of the late Colonel H. D. Pearson, written from Dar Taaisha shortly before his lamented death in the Sudan, which we are kindly permitted to print as a supplement to the Obituary notice which appeared in the March number:

"I had one very great stroke of luck coming across the Goz. There is a curious ironstone cliff drop of a hundred feet or so, and I cleared a place right

on the edge and spent the night there, hoping that I might have the luck to spot Higeir Fatma.* If I did, it meant the possibility of joining the whole five or six hundred miles of the northern work with the five or six hundred miles of the south. It was beautifully clear, but though I sat with my eyes glued to my field glasses to sundown there was no sign whatever. However, I took astronomical observations, and was up in my pyjamas with a coat (warm British) over them, continuing the gaze before sunrise in the morning. I am too old a bird to be caught, and had everything ready, theodolite up and levelled, when suddenly the morning refraction lifted the little hill above the horizon for I suppose less than a minute; but I was ready for him and clapped him at once and connected him with a friendly tree a mile away and so got his angle. Having done this he had again completely disappeared. But he had been booked all right, and the connection can now be made. It is a very small hill and was about a 40-mile shot, impossible without at least a month's work and tremendous arrangements for carrying water to have got the connection any other way.

"The country is not nice travelling. The going has been quite good, but the grass is feet over one's head everywhere, and one sees not two yards ahead."

AMERICA

Post-glacial Lakes in the Mackenzie Basin.

In the *Journal of Geology* for July–August 1922 (vol. xxx., No. 5) Mr. A. E. Cameron endeavours to reconstruct the great lakes which must have formed in front of the great Keewatin Glacier on the retreat of the ice at the close of the last glacial period, and of which the existing lakes in the Mackenzie basin are probably the remnants. As the ice retreated towards the north-east the run-off from the eastward slopes of the Rocky Mountains would be impounded, and the lakes so formed would expand laterally in a direction generally parallel with that of the Mackenzie River of to-day. The paper is in part based on Mr. J. B. Tyrrell's report on "Athabasca Lake and Churchill River" published in the Annual Report of the Geological Survey of Canada in 1895, which makes frequent reference to the great post-glacial lakes and the higher level than the present at which they then stood; but the conclusions are also supported by the writer's own observations. From these and from the profiles supplied by the Dominion Topographical Surveys, he endeavours to determine a series of levels which from their constancy over large areas, and the concordance of the associated old shore-lines, may be taken to represent different stages of lake formation developed with the retreat of the ice-sheet. In a series of sketch-maps he shows the probable position and extent of the lake expansions corresponding respectively with the 1600-foot, 1100-foot, 800-foot and 700-foot level of the water in the region of the Peace River, Lake Athabasca and the Great Slave Lake. With the fall in level there is of course a general displacement to the north-east, until at the final stage the water surface coincided with somewhat exaggerated versions of the two great lakes still remaining. In the course of these events the disappearance of the ice barrier, coupled with differential movements of the surface, are supposed to have caused the drainage of the basins to find its outlet in different directions at different times, and also to have caused the water-level to fall more rapidly in some parts than in others. Mr. Cameron allows that these conclusions are based on somewhat scanty data and will no doubt bear much correction. But he feels sure that the out-

* On the western border of Darfur, in about 10° 15′ N., 23° E.—Ed. *G.J.*

lines suggested are at least approximately correct. Further study of the old lake-shores may help to determine the time that has elapsed since the last glacial age.

AUSTRALASIA AND PACIFIC ISLANDS

Pan-Pacific Science Congress, 1923.

The successful inaugural meeting of this Congress, held at Honolulu in August 1920, is to be followed this year by a second meeting, to be held in Australia in August. The Australian National Research Council, on the representation of which this decision has been arrived at, announces that the meeting will be opened at Melbourne on Monday, August 13, ending there on August 22, when members will leave for Sydney. The Sydney meeting will open on Thursday, August 23, ending on Monday, September 3. Every effort is being put forth to make the meeting truly representative of all scientific workers interested in the Pacific, and it is hoped that many such besides the official representatives of the countries bordering the Pacific will attend. Housing and accommodation will be provided free to duly accredited visitors from overseas, and it is hoped that free railway passes will also be secured for them. A strong committee has been formed to act in conjunction with the Australian National Research Council, presided over by Prof. Orme Masson, with Mr. R. H. Cambage as Hon. Secretary-Treasurer. Seven groups of subjects for discussion are laid down, those of special interest to geographers being those of geography and oceanography, geology, and physics, the last including geodesy, geophysics, seismology, etc. We wish the meeting every success.

GENERAL

The Thermal Limit of the Occurrence of Ancient Cities.

In a short paper read before the British Association last year at Hull and printed in the *Scottish Geographical Magazine* for January 1923, Dr. Vaughan Cornish drew attention to the fact, not hitherto, he thinks, sufficiently recognized, that "the northern frontier of ancient cities on the eve of the barbarian irruption has, within narrow limits of variation, the same average temperature throughout." This fact is brought out by taking (as in such a connection it is only right to do) the true annual isotherm and not one reduced to sea-level. Taken together the frontiers of the four great Powers of the early centuries of our era—Rome, Parthia, Kushan, and China—formed an unbroken line from Holland to Korea. For the European section modern meteorological data show that the mean annual temperature of important cities near the line varies only between 46·6° and 50·2° F., while that of towns somewhat further north in Asia (sufficient observations along the frontier being here wanting) give a mean proportionally lower. While not attempting to press unduly the significance of the coincidence thus established, Dr. Cornish meets the possible objection that it is merely due to the unsuitability of the southern countries to pastoral peoples by saying that in Asia there was much coveted grazing land south of the settled frontier. May not the frontier, however, have been here determined by the *absence* of suitable lands for a sedentary population *north* of the same frontier? That the *total* amount of heat received from the sun during the year may be of some importance in controlling distributions may be conceded, but it may be doubted whether its importance is not overrated by Dr. Cornish in the example given by him—that of the cultivation of the vine.

International Air Congress, London, 1923.

We are asked to state that, at the invitation of the British Government, an International Air Congress will be held in London during the week 25–30 June 1923, under the Presidency of H.R.H. the Duke of York, with Lord Weir of Eastwood as Vice-President, and the Duke of Sutherland, Under-Secretary for Air, as Chairman of the Main Committee. The main object of the Congress is to provide opportunities for the reading and discussion of papers on every aspect of air matters. By a division of the Congress into four groups, each again divided into sub-groups, which will meet simultaneously, persons specially concerned with one aspect of the subject will be able to devote their attention to this particular interest. Papers will be read on the Monday, Wednesday, and Friday, Tuesday and Thursday being devoted to visits to places of interest, while the Air Ministry have arranged for an air pageant to take place on the Saturday. Members of the R.G.S. who are British, or nationals of a country represented on the Fédération Aéronautique Internationale or a signatory of the International Air Convention, are eligible for membership, the subscription for which is £1. Further particulars can be had on application to the General Secretary, Lieut.-Col. W. Lockwood Marsh, c/o the Royal Aeronautical Society, 7, Albemarle Street, London, W.1.

Proposed Memorial to the late Dr. Reginald Koettlitz: Appeal for Subscriptions.

We are glad to publish the following appeal by Captain Charles Royds, R.N.:

Information has been received from South Africa that the grave of Dr. Koettlitz, who died at Cradock in 1913, remains unmarked in any way, there being no permanent record of his resting-place, not even a name on his grave.

Dr. Koettlitz saw service in the Jackson-Harmsworth Expedition to Franz-Josef Land; he also went with Lord Lovat on the expedition to Abyssinia. In 1901 he was appointed Senior Surgeon and Scientist to the National Antarctic Expedition, which was commanded by the late Captain Robert Falcon Scott, R.N., and which sailed in the *Discovery* under the combined auspices of the Royal Society and Royal Geographical Society. It would seem a very right and desirable thing to place some memorial in the local church and on his grave, to a man who was a sterling, modest, upright, and loyal character, and who devoted so much of his life to the advancement of science and exploration without seeking notoriety or reward.

With this end in view, an appeal is made to the Fellows of the Royal Geographical Society; and donations, however small, will be gratefully received. The sum required is only £100. It is hoped that the many Fellows who knew Dr. Koettlitz will be pleased to contribute, as doubtless will others who feel that something should be done to perpetuate his memory. Subscriptions should be sent to Captain Charles Royds, R.N., The Admiralty, London.

Dr. Nansen wrote in answer to an appeal:

"I think it is most regrettable that so little has been done in memory of our friend Dr. Koettlitz, and I am glad you gave me the opportunity to contribute my little share towards his memorial. I wish you all possible success in your noble undertaking. Koettlitz was indeed a good man and a fine character, and it is always a pleasure to think of the time when we were on Franz-Josef Land together."

OBITUARY

Henry John Elwes, F.R.S.

WE record with regret the death, which occurred on November 26 last, of Mr. H. J. Elwes, a well-known representative of the class of naturalist-travellers who, though not strictly explorers in the geographical sense, are contributors to geographical knowledge by the extent of their wanderings through little-known countries in pursuit of their own special studies. The eldest son of Mr. J. H. Elwes, of Colesbourne Park near Cheltenham, to the ownership of which he succeeded in due course, the subject of this notice, after receiving his education at Eton and abroad, and serving five years in the Scots Guards, was able to gratify his love of travel and Natural History by journeys in various parts of Asia, North America, and South America, and met with considerable success as a big-game hunter. His scientific interests embraced especially botany and horticulture, entomology and ornithology, on all of which, as well as on zoology in general, he brought back copious material which he put before the learned societies interested in an extensive series of communications. He was a member of the Mission through Sikkim to Tibet in 1886, and made a report to the Geographical Section of the British Association in 1888, in which he advocated a route from India to Tibet by a pass not previously used. In 1898 he made a journey into the Altai for the study of the fauna and flora of the range, and though it proved impossible to carry out his plan of exploring the Upper Yenesei region and Mongolia, he brought back useful data on the general features of the Altai and the distribution and conditions of life of the plants and animals of the range. In 1914 he had visited Nepal in company with the late Mr. Trevor-Battye. He had been President or Vice-President of several learned societies, including the Entomological, and had been a Fellow of our Society since 1913.

James Bennet Peace.

The Society shares in the general regret at the premature death of Mr. J. B. Peace, the Cambridge University Printer, who had been a Fellow since 1918. His sudden death on January 30, before completing his fifty-ninth year, came as a shock to his many friends in the University, where his loss will be severely felt both at the Press, his College (Emmanuel), and in the University at large. A man of wide interests and great business capacity, Peace was at home in many different branches of knowledge. After a course of study at Aberdeen, he entered Emmanuel in 1880, and distinguished himself both in his studies and on the river, being 5th Wrangler in the Mathematical Tripos of 1887, and taking his College boat to the place of second on the river. In 1893 he became Bursar of his College, a post which he held for twenty-seven years. Among his other interests he had acquired considerable knowledge of mechanical engineering, in which subject he became University Lecturer, and his understanding of all that appertains to building construction was put to good use in connection with the successive extensions of Emmanuel during his Bursarship. A good general knowledge of farming served him in good stead for the management of the College estates. During the war he did useful service in the munition works, and on the death of the previous University Printer, Mr. John Clay, in 1916, he was appointed to the vacant office, although without previous experience of printing; but

his successful seven years at the Press, where he gained the affection of all who worked under him, fully justified the choice.

Although he only joined the Society four years ago, geography had been one of his interests from his early days.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1922–1923

Seventh Evening Meeting, 26 February 1923.—Colonel Sir Francis Younghusband, Vice-President, in the Chair.

ELECTIONS: Cyril George Beasley; Captain Hubert Berkeley, I.S.O.; William Fyfield Broadway; Captain John Geoffrey Bruce; Rajendra Nath De; Brevet-Major Bernard Russell French, D.S.O.; Charles E. Gunther; Mrs. Violet Harter; Captain Wilfred John Howell; Lieut.-Colonel Neal Douglas-Matheson, D.S.O., M.C., R.E.; Major Sherman Miles; Brevet-Major Guy Warneford Nightingale, M.C.; Steven Beresford Bankole Rhodes; W. A. G. Taylor; Edwin Godwin Thomas; Maurice F. G. Wilson; Brig.-General Charles Richard Woodroffe, C.M.G., C.V.O., C.B.E.

PAPER: The Flight from London to Calcutta. Major W. T. Blake.

Eighth Evening Meeting, 12 March 1923.—The President in the Chair.

ELECTIONS.—Miss Ethel Behrens; Victor Bonney, M.D., F.R.C.S.; Oscar Lisle Brady; Lieut.-Colonel H. Edmund Bullis; Major A. H. Burn, C.I.E., O.B.E., I.A.; Edward John Burrow; Philip Hemenway Chadbourn; Sir Herbert Benjamin Cohen, Bart.; Eric Alfred Humphery Fenn; James Harbury Flint; Major Bernard Vernon-Harcourt; George Alexander Hobler; Miss Alice Mary Holdsworth; J. Joseph; Preston Erie St. Clair Locke; Major Roderic William Macklin, M.C.; Captain James Edward Morris; Frederick William Robins; Frederick Victor Grey Wymark.

PAPER: Air Survey and British Archæology. O. G. S. Crawford.

Fourth Afternoon Meeting, 19 February 1923 —The President in the Chair.

PAPER: The Influence of Man as an Agent in Geographical Change. Dr. R. L. Sherlock.

Fifth Afternoon Meeting, 19 March 1923.—The President in the Chair.

PAPER: Recent Developments of Air Photography. Colonel M. N. MacLeod, Squadron-Leader F. C. V. Laws, R.A.F., Major J. C. Griffiths.